Augustine A Stobtowe

New and Complete Syſtem

OF

Practical Huſbandry;

CONTAINING

All that Experience has proved to be moſt uſeful in

FARMING,

EITHER IN THE OLD OR NEW METHOD;
With a Comparative View of Both;

And whatever is beneficial to the HUSBANDMAN, or conducive to the Ornament and Improvement of the

COUNTRY GENTLEMAN'S ESTATE.

By JOHN MILLS, Eſq;
Editor of DUHAMEL's Huſbandry.

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PREFACE.

OUR utmoſt attention to Agriculture never was more neceſſary than at this period, if we would preſerve that ſuperiority which we have hitherto enjoyed over every nation in Europe; except, perhaps, the inhabitants of the Auſtrian Netherlands, and thoſe of the United Provinces, whoſe love of liberty, joined to an indefatigable ſpirit of induſtry, has rendered them ſingularly careful to improve their huſbandry, which they wiſely look upon as the ſureſt baſis of independence. ---- Such we alſo have long experienced it to be; and ſuch we ſhall ever find it, ſo long as we continue to cheriſh this origin of our power.---But, let us beware of too great ſecurity. --- let not a fond opinion of our now juſtly claimed pre-eminence in this art induce us to imagine, that no other people will, at any time, be able to equal us therein. Daily experience proves that, with all our knowledge, we may yet learn many

eſſentially uſeful things, even from thoſe whoſe ſkill in theſe matters in general, is allowed to be, at preſent, much inferior to our's. --- How long it may continue ſo, will depend on our care and aſſiduity: for that nation may be ſaid to retrograde, whoſe induſtry ſtands ſtill, while that of her neighbours proceeds with unremitted diligence. That the former is not actually our caſe, is certain: but at the ſame time, the daily proficiency of the French in affairs of agriculture, of which we have ſeen many very ſtriking inſtances in the courſe of this work, ought, whilſt we juſtly admire and applaud it, to be to us the ſtrongeſt of inducements to exert ourſelves, in order ſtill to keep before them. Their efforts to overtake us will undoubtedly be redoubled now, that their king has wiſely inſtituted a Royal Society of Agriculture, and condeſcended to declare himſelf the immediate patron and protector of every rational endeavour to improve the ſcience of huſbandry. --- A ſimilar Inſtitution here, under the auſpices of our moſt gracious Sovereign, would add new ſplendor to the Britiſh Throne, and firmly eſtabliſh the poſſeſſion of all our real advantages.

"They who judge of the agriculture of "a whole country by the flouriſhing condi-"tion of a few diſtricts juſt around it's cities "or great towns, judge too haſtily"; as is rightly obſerved in the preface to the third volume of the Memoirs of the excellent

Society

Society of Berne [a]. "The compariſon of "thoſe places, generally favoured by nature, "and always aſſiſted by art, ſerves only to "ſhew what induſtry and good culture "might do with lands which lie totally "neglected.

"The reſources of good huſbandry are as "infinite, as the fruitfulneſs of the earth is "inexhauſtible, when this is rightly cultivat-"ed [b]. Providence, in enabling it to yield "innumerably various productions, ſeems to "have intended it for the ſupport of a race "of men much more numerous than the "preſent race, greedy as theſe are to poſſeſs "more than they know what to do with, "and madly bent upon deſtroying one ano-"ther for the tranſient property of ſuper-"fluous land.

"Never, perhaps, did nations attempt to "rival each other in Agriculture, more "ſtrongly than they now do. We ſee among "them all a noble emulation, which promiſes "a happy revolution in favour of mankind. "Genius, after having dwelt ſucceſſively on "all the ſpeculative ſciences, now chooſes to "fix upon objects which are immediately "connected with the welfare of ſociety.

"Many excellent men, and many good "writers, have made the commerce, the arts, "the finances, in ſhort, all the reſources of "the power of ſtates their principal, if not

[a] *Page* 14. [b] *page* 18. and 19.

"their only, ſtudy. So many voices have "been raiſed on all ſides, that kings have at "length been perſuaded to meaſure the "ſtrength of their ſceptre by the number "and welfare of their ſubjects. Mighty fleets, "numerous troops, and ſtrongly fortified "places, are now the means by which every "ſtate ſecures it's public tranquility, and pro-"tects it's frontiers. Theſe formidable pre-"paratives are made only by dint of men "and money. The latter is derived from the "induſtry of the ſubject, the former depends "on population; and the primary cauſe of "this double means of all power is in agri-"culture. Alliances, victories, and even new "conqueſts, give to a nation but a momen-"tary and precarious power: the revenues "ariſing from an increaſe of induſtry, or from "an enlarged commerce, both of which are "the happy effects of a vigilant and active "adminiſtration, increaſe the relative power "of a ſtate; but ſtill that power is only con-"ditional and dependant. The reſources of "the earth, and the ſtrength of population, "can alone be looked upon as the founda-"tions of a ſure and poſitive power, and as "the means by which a nation is enabled to "ſuffice for itſelf."

Not having been able to compriſe in my ſecond volume every article relative to the management of grain; I have, in this, treated firſt of the Enemies to Corn, beginning with

with Weeds, than which no one requires more the attention, induſtry, and perſeverance of the farmer, who muſt extirpate them before he can have complete crops. I then point out the ſeveral kinds of Vermin moſt noxious to the huſbandman, and indicate the moſt approved methods of guarding againſt, or deſtroying them. Here, a full account is given of that formidable inſect which has long deſolated, and had at length almoſt entirely laid waſte, a whole province in France. The nearneſs of our ſituation to ſome parts of that kingdom, and the parity of latitude between France and ſome of our colonies, where the ſame circumſtances in the air may be productive of the ſame effects, if any of it's eggs ſhould unfortunately chance to be brought here, or carried thither, rendered it neceſſary to expatiate on the means of deſtroying that amazingly pernicious brood: and this I have done the more readily, as the ſame precautions bid fair to extirpate every other inſect that breeds in corn. --- When I ſay, that my guide in this has been M. DUHAMEL, the reader will juſtly expect that accuracy which diſtinguiſhes his works, and that ſucceſs which here happily attended his labour. --- The Preſervation of Corn, both in granaries, and in tranſporting it in ſhips, an article of conſiderable importance to every maritime nation, concludes the ſecond part of this treatiſe.

Paſtures,

Paſtures, taken in a much more extenſive ſenſe than the generality of writers on agriculture have hitherto conſidered them, are the ſubject of my third part; in which, comprehending under that name whatever is, or may be, properly uſed for the food of cattle, I begin my firſt chapter with treating of ſuch plants as may be cultivated interchangeably with corn or pulſe. Almoſt the whole of this is new, in the light here repreſented, and therefore will, I hope, be of proportionably greater ſervice; becauſe it creates a fund of paſture, hitherto little known in this country. ---- The ſecond chapter treats of what is commonly called artificial graſs: an article from which our farmers have of late experienced many great advantages, but which they have not yet carried to near the perfection of which the experiments here related prove it to be ſuſceptible.

In the third chapter of this part, I have endeavoured to draw a fair compariſon between the old huſbandry and the new, by relating facts, which ſpeak for themſelves, and ſeem plainly to ſhew, that though the advantages of the horſe-hoeing method may not be immediate, or very ſtriking, in the culture of corn; they are indiſputable in that of pulſe, of roots, and of various articles which have lately enriched the eſſential article of Paſtures. Thus much is evident, even from the few trials that have been made of it in this kingdom.

dom.--- I am ſorry to ſay the *few*: but hope my countrymen will ſoon ſet examples, which (excepting the experiments communicated by three patriots * *only*, in all this kingdom!) I have hitherto been obliged to borrow from foreigners.

As almoſt every country, eſpecially, if the climate differs, has it's particular ſorts of natural graſſes, which are the ſubject of my fourth chapter; I have here pointed out the means of aſcertaining the comparative value of each, and have given particular deſcriptions and drawings of ſuch as promiſe the beſt ſucceſs in this country.

The Appendix at the end of this chapter was occaſioned by a letter with which I was honoured by that excellent patriot the Marquis of Turbilly, who, with that admirable greatneſs of mind which ſtudies to extend every part of uſeful knowledge, was pleaſed to ſend me a particular account of the culture of the great Anjou cabbage: but too late to be inſerted in a more proper place.

My fifth chapter treats of a part of huſbandry in which the Engliſh have hitherto greatly excelled every other people: I mean, the incloſing of land; from which we daily

* One of theſe, whoſe cultivation of lucerne in Surry is mentioned in p. 247 of this volume, has informed me, ſince that account was publiſhed, that no dung, or manure of any kind, has ever been uſed upon his land, ſince it's being under the lucerne. — The reader will be pleaſed to remember this remark.

reap

reap ſuch vaſt advantages, as leave room only to wonder, that there ſhould yet remain among us prodigious tracts of now abſolutely waſte, though in fact, highly improveable, land. --- How immenſely might the power and wealth of this nation, the ſplendor and revenues of the crown, and that moſt important object, population, the true bulwark of the ſtrength and glory of a ſtate, be increaſed, by incloſing, and cultivating, many parts of the extenſive foreſts, heaths, and commons, in this puiſſant kingdom! The infinite benefits that would accrue therefrom, are evident to a demonſtration.

I cloſe this volume with a ſubject truly intereſting to every inhabitant of the country, *viz.* the choice of proper ſituations to live in: for on that the health, and conſequently the welfare, of them all muſt greatly depend.

THE

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PRACTICAL HUSBANDRY.

PART. II.

CHAP. III.

OF ENEMIES TO CORN.

BESIDES the diſtempers treated of at the end of the preceding volume of this work *, and which might have been ranked under the general title of this chapter; corn is expoſed to many other accidents, before it ſprouts in the earth, while it grows, and after it is laid up in ſtacks, barns, or granaries. The careful huſbandman will exert his utmoſt endeavours to guard againſt theſe evils, which proceed chiefly from weeds, vermin, and inſects; for the remov-

* See *Vol.* II. *p.* 381—429.

ing and deſtroying of which I ſhall point out the methods hitherto beſt warranted by repeated experience, taking them progreſſively as they affect the corn, from the time of it's being ſown.

The damages occaſioned by inclement ſeaſons, ſtorms, high winds, hail, violent rains, and other ſuch like events, cannot be totally prevented by any human prudence; though proper incloſures, which will be ſpoken of hereafter, will contribute, greatly to abate their miſchievous effects. The farmer can do nothing more to his corn fields for ſome time after he has ſowed them, than to take care that his fences, drains, and ditches be in good order.

As to hard winters, they are frequently of ſervice to corn in many reſpects; eſpecially if the land has been thoroughly drained, and is well covered with ſnow. This laſt mellows the ground and keeps it warm; while froſt, neither the rigour nor duration of which need be feared if it comes on gradually, and the land is dry, not only kills great numbers of vermin and inſects, but, by leaving the earth in a looſe ſtate, fits it for roots to extend themſelves therein as the warmth of the ſpring approaches, and thereby enables them to produce ſtrong plants: whereas frequent rains in the winter, without froſt, ſadden the earth, which afterwards produces nothing but blades, ſoon to be deſtroyed by the hoar-froſts of the ſpring, by inſects, and by weeds, or which would yield at moſt only ſtraw without grain. The winter's froſts may indeed nip off the blades; but then, the roots being unhurt, new ones will ſhoot up in the ſpring. This was the caſe in the remarkably ſevere winter of 1608, of which Mezeray ſpeaks, and which, notwithſtanding it's extreme ſeverity, was followed by a plentiful harveſt; and ſuch alſo, or nearly ſuch, was the long winter of 1729[a].

The

The great danger from froſts is when the earth is wet and not covered with ſnow: for example, if a ſtrong froſt returns after a ſudden thaw, the fibres of the roots are broken by the expanſion of the ſurrounding water when frozen, and the too great abundance of moiſture in the plants themſelves, when frozen, tears their fibres to pieces by the ſame expanſion. This was what happened in 1684 [b].

Early in the ſpring of 1710, the parliament of Paris, hoping that the corn cut off by the preceding winter would ſhoot out again, as it did after the winter of 1608, mentioned by Mezeray, forbid ſowing anew the lands which had been ſown the autumn before: but the expectation now proved groundleſs; the plants having been totally deſtroyed by repeated froſts intermixed with frequent thaws: ſo that had it not been for the barley that was ſowed afterwards, which yielded ſuch prodigious crops that the French ſtill call that year the *year of barley*, (*l'année des orges*,) the dearth muſt have been much more dreadful than it was. In that very ſpring, after the hard winter, ſeveral people in the dutchy of Berry and elſewhere ſowed wheat, which ſprouted well, and grew, but did not ſpindle; whereupon ſome mowed their crops, and others turned in cattle, to feed as in a meadow: but after another winter had paſſed over them, thoſe very fields yielded, the next year, as plentifully as if they had been ſown anew. In incloſed grounds, the corn near hedges which ſcreened it from the north wind, reſiſted all the rigour of that exceſſive cold: and in other places, where the poor peaſants raked up all the ſnow they could collect,

[a] *Maiſons Ruſtiques, Tom.* I. *p.* 638. [b] *Ibid.*

and ſpread it with their hands upon the uncovered ſpots of their ſmall fields, their corn was preſerved, and yielded a good crop [c].

A gentleman now living in England had a field of wheat ſo greatly damaged by alternate froſt and thaw, that the neighbouring farmers thought he could not do better than plow it up for ſpring corn. But, obſerving that many of the plants were yet alive, and in a condition to be recovered, though thinly ſcattered, he hand-hoed the whole, and reaped three quarters of corn from each acre of this land.

An extremely wet and rainy ſpring is generally followed by a very bad harveſt, becauſe the corn has then been choaked and ſtarved by a multitude of weeds. Thoſe are likewiſe the years in which diſtempers are moſt apt to reign among the common people in the autumn; owing, perhaps, to the bad quality of the corn, which has not had ſufficient nouriſhment, or to it's being greatly mixed with the ſeeds of weeds.

The blooming ſeaſon of the corn generally decides the fate of the enſuing harveſt. It may be expected to be good, if the corn then ſtands well and is ſtrong; unleſs ſome of thoſe fatal accidents, which the power of man cannot guard againſt, ſuch as hail or blight, ſhould unhappily fruſtrate the huſbandman's otherwiſe well grounded hope. His principal care at this ſeaſon muſt be, to keep his ground free from weeds; a ſubject which, though treated of before in a general manner *, is of ſuch importance as will juſtify my adding here ſome more particular remarks.

[c] *Id. ibid. p.* 639. * See *Vol.* I. *p.* 284—288.

SECT.

SECT. I.

Of Weeds.

THE judicious farmer will not attempt to weed his corn before the beginning of ſpring, on account of the great danger of pulling up many of the young uſeful plants, with thoſe which he wants to extirpate: and yet he ſhould not wait too long before he ſets about this very neceſſary work; becauſe the noxious growth will multiply apace, and ſpeedily rob the ſoil of great part of it's nutritive juices. His eye muſt help to direct him when to perform this eſſential operation; and he muſt, above all, be particularly careful never to let any weeds grow ſo big as to choak or overtop his corn, or ſtand till their ſeeds ripen and ſow themſelves. This laſt accident is moſt to be feared from the leſſer kind of weeds, which are too often paſſed over un-heeded, and of which the increaſed multitudes ſoon become extremely prejudicial. Repeated weedings are therefore indiſpenſably neceſſary; that what has eſcaped at one time, may be noticed at another, and that the pernicious race may be rooted out as faſt as it appears. The firſt weeding ſhould be as early in the ſpring as it is poſſible to diſtinguiſh which are weeds, and which are not; and the ſame buſineſs ſhould be repeated, for the ſecond time, at fartheſt when the corn has begun to ſpindle. It frequently is for want of good weeding that we meet with ſo many lank half-ſtarved ears, which afford only meagre, ſhrivelled, ſpotted, unwholeſome grains, diſagreeable to the taſte, and not half ſo full of flour as thoſe of ſound corn.

The beſt time for weeding by hand is after a gentle ſhower has moiſtened the ſurface of the

earth: becauſe the weeds are then moſt eaſily drawn out with their roots, which are apt to break when the ground is too dry; and in this caſe the remaining pieces, particularly of thoſe which are of the creeping perennial kind, will ſoon produce new ſhoots, which will become as hurtful as the old ones.

If the ſpring is wet and warm, and if it rains much in May, abundance of weeds will then ſpring up, and great care ſhould be taken to deſtroy them immediately. The mild ſhowers which are ſometimes almoſt continual in June, produce the ſame diſadvantageous effect. Then, eſpecially, it is that every ſpecies of the bind-weed ſhoots up with vaſt rapidity, twirls itſelf round the corn, reaches it's top-moſt height in eight or ten days, and drags it down ſo as to deprive the ears of all farther ſuſtenance. Only the warm rains in June, and not the the cold ones, engender this noxious production. Particular care ſhould therefore be taken to pluck up all weeds, and ſingularly this, in April, May, and June: otherwiſe there will be danger of reaping ſtraw only, inſtead of corn.

The weeds themſelves may be given to cattle, either green, or dried in the ſun. If dried, they ſhould be laid in heaps to ſweat; after which they may be uſed as hay. The poor in many countries are glad to have them for the reward of their labour in picking them out from among the corn.

But theſe inſtructions are only for the ſlovenly farmer: for ſuch crops of weeds never appear in ground in due order. I ſhall therefore point out the moſt effectual means of eradicating them entirely. Theſe are different, according to the different qualities of the weeds; namely, whether they are propagated by their roots and ſeeds, but chiefly by their roots; or by their ſeeds alone:

for

for each of theſe requires a different treatment. And I ſhall alſo mention, in the courſe of this detail, ſome of the profitable uſes that are or may be made of ſeveral of theſe enemies to corn, or of the ſpecies belonging to them.

Of the perennial rooted kind, which are beſt deſtroyed by repeated ſummer fallows, wherein it is eſſentially material that every piece of root be taken away and burnt, becauſe, in many of ſuch, every joint will produce a new plant; the moſt hurtful to the farmer, and the moſt apt to abound, are the

Bind-weed, by ſome called with-wind (*Convolvulus*), of which, conſidered as a weed, there are two principal ſorts, the great and the ſmall. It's root is perennial, but it's ſtalk annual. Mr. Liſle, after obſerving that he believes it propagates itſelf in paſture ground chiefly by it's ſeeds, and by it's roots in arable land, becauſe it ſeems to flower too late in corn, to ſeed before the corn is cut; rightly aſſigns as a reaſon why it is moſt apt to multiply in ſtrong clayey ſoils, that ſuch ground being, in the common practice, plowed only in the winter months, after wheat, for ſuch other crops as peas, barley, or oats, and not till about September for winter-vetches; this tillage cannot deſtroy the roots or ſeeds of weeds like the ſummer-fallows for wheat; but, on the contrary, promotes their increaſe, particularly from the off-ſets or joints of the roots. "I have known, "ſays he, [c] in this caſe, clay-land folded for bar-"ley, and particularly that part of it which, "waiting for the folds going over it laſt, was lateſt "fallowed, bring up ſo great an increaſe of with-"wind, that, though the ſpring and ſummer had "been very dry, every ſtem of barley had a with-

[c] *Obſervations in Huſbandry, Vol.* II. *p.* 303. *2d. Edit.*

"wind

" wind round it. As the fold brought up a crop
" of this corn, it brought up with each plant it's
" enemy, which would eat it out, pull it down
" before it could ripen, and thereby prevent the
" filling of the grain. The crop is alſo greatly
" hazarded here, after it is cut, by the danger it
" muſt run by laying in ſwarth till this weed is
" withered, before it can be carted.—Again, near
" the end of the firſt ſummer, after the firſt year
" of a crop of hop-clover, which I fed, that is,
" about the beginning of Auguſt, I fallowed a
" ground for wheat, then dunged the fallows, and
" ſowed my wheat before Michaelmas. I had a
" very good crop of wheat: but a with-wind
" came up to every plant; ſo that had it been a
" wet and cold ſummer, inſtead of a hot and dry
" one as it chanced to be, my corn would have
" been pulled down and lodged while green in the
" ear, and in the milk, and could not then have
" filled in body and flour, but muſt have been of
" the nature of blighted corn. The increaſe of the
" with-wind here was, without doubt, occaſioned
" by the laying down this ground only to one
" ſummer-feed after the hop-clover was ſown,
" when it had borne three or four crops of ſum-
" mer-corn after it's wheat crop: for by the
" winter plowings, as I intimated before, the off-
" ſets of the roots of weeds, and their ſeeds, were
" propagated. I could not conveniently deſtroy
" theſe roots or ſeeds by giving the ground a
" ſeaſonable ſummer-fallow in the beginning of
" June, becauſe I ſhould then have loſt the fruits of
" my hop-clover crop, by plowing it in at the be-
" ginning of the firſt ſummer; though this would
" have contributed much to the killing of the
" with-wind: whereas by delaying the fallowing
" three months longer, *viz.* to the beginning of
" Auguſt, when the ſun had loſt it's ſtrength to
" burn

" burn up the roots and malt the ſeeds, and it " was too late for the ground to lie long to a " fallow, the dung laid on the fallows gave new " life to the roots and ſeeds."

Mr. Philip Miller, who enumerates thirty-two ſorts of *Convolvuli*, of which only the two before mentioned are deemed weeds, is very certain [d] that the *Convolvulus foliis variis, pedunculis unifloris, radice tuberoſâ*, or bind-weed with variable leaves; footſtalks with ſingle flowers, and a tuberous root, is the true medicinal Jalap, which now grows naturally at Haleppo; between La vera Cruz and Mexico. This was firſt ſuſpected by the learned Mr. Ray, and afterwards aſcertained by the late Dr. Houſtoun, who carried ſome of the roots of this plant from the Weſt-Indies to Jamaica, where he planted them, and found them thrive. His deſign was to cultivate the Jalap there: But ſoon after he left that country, the perſon to whoſe cuſtody the plants were committed, was ſo careleſs as to ſuffer hogs to root them out of the ground and deſtroy them, ſo that there were no remains of them left when he returned thither: nor is there any account of this uſeful plant's having been ſince introduced into any of the Britiſh iſlands; though the conſumption of it is now ſo great, ſince the diſtillers and brewers have found out it's uſe for exciting a fermentation, that the cultivating of it in ſome of our warm colonies, for it is a tender plant, would become a national benefit: and this might be ſoon effected, if the inhabitants of thoſe parts were a little more attentive to their own, and to the public good. It's importance, in this light, will be a ſufficient apology for my having dwelt ſo long upon it here: for the quantity of it uſed in medicine is not alone ſuffi-

[d] *Gardener's Dict.* Art. CONVOLVULUS.

cient

cient to render it an object of great concern; though it is esteemed an excellent cathartic, to purge off serous or watery humours, and is of singular service in dropsical and rheumatic disorders. This species of the Convolvulus hath a large root, of an oval form, and full of a milky juice. From that root proceed many herbaceous twining stalks, which rise eight or ten feet high, and are garnished with variable leaves, some of them being heart-shaped, others angular, and others again pointed. They are smooth, and stand upon long foot stalks; and the flowers are shaped like those of the common great bind-weed, each foot-stalk supporting one flower. The seeds are covered with a very white down, like cotton.

Nearly the same medicinal virtues are found in the *Convolvulus foliis reniformibus, pedunculis unifloris*, or Bind-weed with kidney shaped leaves, and one flower on each foot-stalk. This is the *Soldanella maritima minor*, or lesser sea Bind-weed, of Casper Bauhin, which grows naturally on the sea beach in many parts of England, but cannot be long preserved in a garden. It hath many small white stringy roots, which spread wide, and send out several weak trailing branches, which twine about the neighbouring plants, like the common bind-weed, and are garnished with small kidney-shaped leaves.

Another medicinal sort of Bind-weed, distinguished by the appellation of *Convolvulus foliis cordatis, angulatis, caule membranaceo, quadrangulari, pedunculis multifloris*, Bind-weed with angular heart-shaped leaves, a quadrangular membranaceous stalk, and foot stalks, having many flowers; likewise known by the name of *Convolvulus Zeylanicus, alatus, maximus, foliis Ibisci nonnihil similibus angulosis*, greatest, winged Bind weed of Ceylon, with many cornered leaves not unlike the *althea*; grows

grows naturally in the iſland of Ceylon. This is a perennial plant, has thick fleſhy roots, which ſpread far in the ground, and abound with a milky juice, which flows out when the roots are broken, or wounded, and ſoon hardens into a reſinous ſubſtance, when expoſed to the ſun and air. From the root ſhoot forth many twining branches, which twiſt about each other, or the neighbouring plants, like the common bind-weed. The roots of this plant, which is too tender to live in the open air in England, are the only part of it that is uſed in medicine. They are brought to us from India, and are called *Turpethum*, or *Turbith*, in the ſhops.

The *Convolvulus foliis ſagittatis poſticè truncatis, pedunculis biflоris*, or Bind-weed with arrow-pointed leaves torn behind, and two flowers on each foot-ſtalk, is the *Convolvulus Syriacus* and *Scammonia Syriaca*, Syrian Bind-weed, and Syrian Scammony. This grows naturally in Syria, where the roots of the plants are wounded on purpoſe to let out their milky juice, which is received in ſhells placed under the wounds, and thickens when expoſed to the air. This is what we call Scammony. This ſpecies of the bind-weed is a very hardy plant, and will thrive well in the open air in England, provided it be on a dry ſoil. It's roots are thick, run deep into the ground, and are covered with a dark bark. It's branches, which are ſlender and trail on the ground, are garniſhed with narrow arrow-pointed leaves, and extend themſelves on every ſide to the diſtance of three or four feet. In June and July it puts forth flowers of a pale yellow, and it's ſeeds ripen in autumn; at which time alſo the ſtalks decay, but the roots will abide many years. This and the preceeding ſpecies will undoubtedly do well in ſome of our ſouthern colonies; and our excellent Society for the Encouragemet of Arts, &c. thinks this laſt, which affords

affords the Scammony, of ſuch conſequence as to offer a premium for the cultivating of it.

The ſpecies of Bind-weed which botaniſts term *Convolvulus foliis cordatis angulo-nervoſis, caule repente tubifero*, Bind-weed with heart-ſhaped leaves, having angular nerves, and a creeping ſtalk bearing tubers, proceeds from the root which we generally call Spaniſh potatoe. Theſe roots are annually imported from Spain and Portugal, where they are greatly cultivated for the table; and though they are too tender to thrive well in the open air in England, they may turn to good account in ſome of our American ſettlements. They are cultivated by the roots, in the ſame way as the common potatoe, but require much more room; for they ſend out many trailing ſtalks, which extend four or five feet every way, and at their joints put forth roots, which, in warm countries, grow to be large tubers; ſo that from a ſingle root planted, forty or fifty large roots are produced.

The ſmaller field bind-weed, or gravel bind-weed, which is Caſper Bauhin's *Convolvulus minor arvenſis*, and Linnæus's *Convolvulus foliis ſagittatis utrinque acutis, pedunculis unifloris*, Bind-weed with arrow-ſhaped leaves, pointed on both ſides, and a ſingle flower on each foot-ſtalk, is juſtly deemed a moſt pernicious weed. It is very common upon dry banks, and in gravelly grounds, in moſt parts of England, and is generally a ſign of gravel lying under the ſurface. The roots of this ſhoot very deep into the ground, from whence ſome country people call it devil's guts.

The common larger ſort is Bauhin's *Convolvulus major albus*, large white bind-weed, called Bear-bind. The ſtalks of this will riſe ten or twelve feet high, twining themſelves about trees and hedges, under which this ſpecies is moſt apt to grow. Theſe ſtalks are garniſhed with large

arrow-

arrow-pointed leaves, torn at their baſe. The flowers come out from the ſide of the branches, upon long foot-ſtalks, each ſuſtaining one large white flower. Theſe flowers appear in June, and the ſeeds ripen in autumn, ſoon after which the ſtalks decay to the root: but as every ſmall piece of the root will grow, this, as well as the former ſort, is very troubleſome to deſtroy. However, in an open clear ſpot of ground, good plowing and harrowing, or carefully hoeing down of theſe weeds as they riſe, during three or four months, may extirpate them effectually: for when the ſtalks are broken or cut, a milky juice flows out, and the roots are thereby ſoon exhauſted and decay. The roots of this ſort are white, pretty thick, and extend far on every ſide.

Blue-bottle, which ſome call *Knap-weed*, others *Matfellon*, and others *Centaury* (*Centaurea*). Many of the ſpecies of this genus, of which Mr. Miller enumerates particularly twenty[e], have perennial roots; but that which Botaniſts diſtinguiſh by the appellation of Centaury with ſawed empalements, very narrow entire leaves, indented below *, is Caſper Bauhin's *Cyanus ſegetum*, and our common corn blue bottle, and is an annual plant, according to Mr. Miller, though Mr. Ray and Mr. Liſle think it's root perennial; becauſe, ſays this laſt, [f] it not only puts forth new buds every ſummer at the root, for the growth of the next year; but ſeems alſo not to ſeed early enough, before the corn is cut, to progagate itſelf by it's ſeed in corn lands, in which it moſt abounds, eſpecially in a gravelly ſoil. From an old notion of it's being

[e] *Gardener's Dict.* Art. CENTAUREA.

* *Centaurea calycibus ſerratis, foliis linearibus integerrimis, infimis dentatis.*

[f] *Obſervations in Huſbandry, Vol.* II. *p.* 311.

good

good for ſcabs, ſcald-heads, &c. Some authors have given it the epithet of *Scabious*. It flowers in July, and it's ſeeds ripen in autumn.

Chick-weed, (*Cucubalus*) flowers early in the ſpring, and, if it be ſuffered to grow, ſeveral times in the courſe of the year. The way to deſtroy it is therefore to pluck it up from time to time, before it can ſhed it's ſeed. The berry-bearing ſort, which grows with ſmooth erect ſtalks, globular empalements, and ſtamina longer than the petals †, is the wild *Lychnis*, or white *Behen* of the ſhops. This is a very rambling weed, natural to moſt parts of England, and is frequently called ſpatling poppy. It's roots are perennial, and ſtrike ſo deep into the earth, that they are not eaſily deſtroyed by the plough; for which reaſon bunches of this plant are too common among corn in land which has not been perfectly well tilled. Summer fallows, and carefully harrowing out every part of the roots, which ſhould then be burnt, will here prove the moſt effectual remedy.

Cockle or *Darnel* (*Lolium*), the ſeeds of which are black, and not eaſily ſeparated from the grains of wheat, becauſe they are heavy, and nearly the ſame ſize. Sifting and throwing the corn to a diſtance on a large floor, are the beſt ways of clearing it of theſe ſeeds, which diſcolour bread and give it a diſagreeable taſte, if they are ground with the corn. The darnel-graſs, commonly called Ray or Rye-graſs, is beſt extirpated in arable land by ſummer-fallows, good harrowing, and carefully removing every bit of it's long creeping perennial roots, which would ſoon produce new plants, if left upon the ground, and which ſhould therefore be burnt as ſoon as they are taken off. The

† *Cucubalus caulibus erectis glabris, calycibus ſubgloboſis, ſtaminibus corollâ longioribus.*

horſe-

horſe-hoeing huſbandry will ſooneſt and moſt effectually accompliſh the deſtruction of this growth.

Colt's-foot (*Tuſsilago*). This weed, which delights to grow by the ſides of rivers, increaſes ſo faſt by it's ſeeds and rambling roots, every piece of which laſt will produce a new plant, though they have been broken by the plough, that it cannot be extirpated without much difficulty, and a conſiderable time. Carefully pulling up the roots every time the earth is ſtirred, or the leaſt veſtige of the plant appears, and preventing it's running to ſeed, are the moſt effectual means of deſtroying it in arable land; and this is beſt accompliſhed by the horſe-hoeing huſbandry: but, totally to extirpate it, the ground muſt be laid down long to graſs. One of Mr. Liſle's neighbours almoſt deſtroyed it by two ſucceſſive crops of vetches; and he himſelf is clearly of opinion [h] that it may be killed by letting the land lie a ſufficient time under clover or rye-graſs; becauſe ſays he, the roots of the natural graſs matting more and more every year, will, in five or ſix years, ſo bind the ſurface of the ground, that the colts's-foot will not be able to pierce through it, and will therefore die for want of air. He plowed up broad-clover in the beginning of July, and turned up the roots of colt's-foot, in which he obſerved, between earth and air, many little buds ſhot forth of the bigneſs of the midſummer buds in fruit-trees; probably to be the leaves or flowers of the next year; and at the depth of five, ſix, and even ſeven inches, he remarked here and there a ſhoot, of a callous body, like the root itſelf, from one to four inches long; perhaps deſtined to be future roots. He experienced, that a winter's fallow will not deſtroy theſe roots; and that they cannot reſiſt

[h] Vol. II. p. 308.

the effect of ſummer fallows, in which they are turned up and expoſed dry to the ſun. It is therefore neceſſary to pick them up as clean as poſſible, and burn them: for it is not to be ſuppoſed that all the roots which are turned up in a ſummer fallow will wither of themſelves: on the contrary, ſuch of the buds at the joints of theſe as are buried under ground, and even many of thoſe which only touch the ground, will ſhoot out again if much rain falls, or the ſeaſon be wet.

Corn-flag (*Gladiolus*). This, multiplying exceedingly by it's roots, is a very troubleſome weed in arable land in moſt of the warm countries in Europe, and is extremely difficult to root out. The manner of extirpating it is the ſame as for colt's-foot. It has a round compreſſed tuberous root, which is of a yellowiſh colour, and covered with a brown furrowed ſkin, like that of the vernal crocus. From this root ariſe two flat ſword-ſhaped leaves, which embrace each other at their baſe, and between theſe ariſes the flower ſtalk, which grows near two feet high, having one or two narrow leaves embracing it like a ſheath. The ſtalk is terminated by five or ſix purple flowers, ſtanding above each other at ſome diſtance, and ranged on one ſide of the ſtalk; each of theſe has a ſheath which covers the flower-bud before it expands, but ſplits open length-ways when the flowers blow, and afterwards ſhrivels up to a dry ſkin, which remains about the ſeed-veſſel till the ſeeds are ripe, which is in the beginning of Auguſt. The flowers come out in the latter end of May, or in June. Some of theſe flowers are white, and others fleſh-coloured.

Corn-marigold (*Chryſanthemum*). Mr. Miller enumerates[i] twelve ſpecies of this plant, among

[i] *Gardener's Dict.* Art. CHRYSANTHEMUM;

which

which he properly diſtinguiſhes as weeds, that with leaves which embrace the ſtalks, the upper being jagged, and the lower indented like a ſaw *; and that which C. Bauhin names the greater wild daiſy with a leafy ſtalk †. The former of theſe is the common corn-marigold, too frequent among corn, and in the borders of corn-fields. The latter, which delights more in moiſt paſtures, of which few are without it in this country, riſes with ſtalks near two feet high, garniſhed with oblong indented leaves, which embrace the ſtalks with their baſe. Each of theſe ſtalks is terminated by one white flower, ſhaped like that of the daiſy, but four times as large. It flowers in June. The corn-marigold has a perennial woody root, which ſtrikes deep, requires a conſiderable quantity of food, and muſt therefore be a great enemy to corn. Conſiderable pains muſt be taken before this weed can be extirpated, as it is highly probable that, beſides multiplying by it's roots, it's ſeed will grow if plowed in, as that of the garden marigold will do when dug in. Deep and repeated hoeings are therefore neceſſary, before it can run to ſeed.

Couch, *Couch-graſs*, *Quick graſs*, *Knot-graſs* or *Dog-graſs* ‡, as it is frequently called (*Gramen*), is one of the worſt of weeds among corn, and one of the moſt difficult to extirpate in arable land; every joint of it's long creeping roots being capable of ſoon producing a new plant, after thoſe roots have been broken by the plough. The

* *Chryſanthemum foliis amplexi caulibus, ſuperne latinatis inferne dentato-ſerratis*; likewiſe called the *Chryſanthemum ſegetum*, ro corn-marigold.

† *Bellis ſylveſtris caule folioſo major.*

‡ This is Ray's *Gramen ſpicâ triticeâ repens vulgare, caninum dictum*, common creeping graſs with a ſpike like wheat, called dog-graſs; and Linnæus's *Triticum calycibus ſubulatis triflori acuminatis*, wheat with an awl-ſhaped pointed empalement including three flowers.

uſual method of deſtroying it is by laying the land fallow in ſummer, and frequently harrowing it well over to draw out the roots, every piece of which ſhould then be burnt, for the reaſon before aſſigned. Where this is carefully done, the ground may be ſo well cleanſed in one ſummer, that the remaining roots will not do any great injury to the next crop: but the beſt way is to ſow the land in which this weed prevails, with ſuch things as require the horſe-hoeing culture. The blade of this graſs is ſo rough, that cattle will not feed upon it when green.

Devil's-bit, (*Scabioſa* *) is found in many fields of corn, but more frequently in meadows. It has a ſtrong, thick, fibrous, perennial root, which runs deep into the ground, and ſends out ſeveral branching ſtalks, which riſe near three feet high. The lower leaves are ſometimes almoſt entire, and at others they are cut into many ſegments almoſt to the mid-rib: they are ſeven or eight inches long, and from three to four broad in the middle, hairy, and ſit cloſe to the root. The ſtalks are covered with ſtiff prickly hairs, and garniſhed with ſmaller leaves at each joint. The flowers, which are of a pale purple colour, and have a faint odour, appear in June, upon naked foot-ſtalks at the end of the branches which decay to the root every autumn.

The *Dock* (*Rumex*), of which there are ſeveral ſorts, is ſo remarkable by it's large leaves, that he muſt be a very ſlovenly farmer who ſuffers it to grow to any ſize. If he is at all careful of his land, he will pluck or cut it up as faſt as it appears; which he may eaſily do, it being of the tap or carrot rooted kind.

* So called from *Scabies*, a Scab, which this plant is ſaid to heal.

Dyer's-

Dyer's-weed, or *wild-woad*, by ſome called *weld*, and *baſtard-rocket*, (*Reſeda*), is a troubleſome plant when conſidered as a weed. It's root is long, white, and ſomewhat woody; it's leaves are unequally winged, and entire; it's ſtalks, which are channelled, and garniſhed with ſmaller leaves, riſe a foot and a half high, and are terminated by a long looſe ſpike of pale yellow flowers, which are ſucceeded by a triangular ſeed veſſel filled with black ſeeds. This is a biennial plant, which flowers and ſeeds the ſecond year, and periſhes ſoon after. It is obſerved to make the milk of the cows that feed on it bitter, and to communicate the ſame taſte to the butter and cheeſe made of that milk. Of this ſpecies is the woad very profitably cultivated for dying, and which will be ſpoken of hereafter.

Ground-ivy (*Glechoma*) is one of thoſe trailing plants which ſtrike out roots from the joints of their ſtalks: but as it generally grows under hedges and upon the ſides of banks, it cannot be ſaid to do any injury adequate to the ſalutary effects of it's medicinal qualities.

May-weed, or *Morgan*, a wild ſpecies of Chamomile * (*Anthemis*), is a trailing perennial plant, which puts out roots from it's branches, as they lie on the ground. By this means, and by ſcattering it's ſeeds long before corn is ripe, it ſpreads and multiplies greatly. It flowers in May, and is therefore called May-weed: though ſome have improperly given this name to the *Cotula fœtida*, † which ſeldom bloſſoms till late in June. The means

* It is Linnæus's *Anthemis receptaculis conicis, paleis ſetaceis, ſeminibus coronato-marginatis*, Chamomile with a conical receptacle of briſtly chaff, and and bordered ſeeds; which is C. Bauhin's *Chamæmelum inodorum*, Wild Chamomile or May-weed.

† Linnæus's *Anthemis receptaculis conicis, paleis ſetaceis, ſeminibus nudis*, Chamomile with a conical receptacle, briſtly

of extirpating it are, ſummer fallows, repeated good harrowing, and burning the collected roots, as before directed in ſimilar caſes, or, which will be found ſtill more effectual, the frequent hoeings practiſed in the new huſbandry. What eſcapes theſe clearings, ſhould be very carefully pulled up by hand; for the common weeding hook will not go deep enough to take out the whole of the long ſlender-tap root of this plant, of which every remaining bit that has a knot in it will produce new ſhoots. Nor ought the farmer to regret this ſmall additional expence, to get rid of one of the moſt fatal enemies his corn can have. Mr. Liſle aſſures us[a] that as good a crop of wheat as one would wiſh to ſee all the winter time, was, to his knowlepge, ſo deſtroyed by the coming up of May-weeds and poppies in the ſpring and ſummer, that it did not at laſt yield ſo much as the ſeed.

Mugwort (Artemiſia) is a moſt troubleſome weed, for it's roots creep far under the ſurface of the ground, ſo as ſoon to overſpread a large ſpace, if they are not ſtopped; and it's ſeeds, being light, and eaſily carried to a diſtance by the wind, will produce numbers of new plants the next Spring. It has plain cut leaves, ending in many parts, woolly underneath, and ſingle ſpikes of pale yellow oval flowers, which blow in June.

The *moxa*, ſo famous in the Eaſtern countries, for curing the gout, by burning the part affected, is the down on the under part of the leaves of a ſpecies of mugwort, ſuppoſed to be different from our common ſort ‡. But Mr. Miller judges, from

chaff, and naked ſeeds; and C. Bauhin's *Chamæmelum fœtidum*, ſtinking May-weed.

[a] *Obſervations in Huſbandry*, Vol. II. *p.* 305.

‡ Which is Linnæus's *Artemiſia foliis pinnatifidis planis inciſis ſubtus tomentoſis, racemis ſimplicibus, floribus ovatis, radio*

from the dried ſamples of it brought to England, and ſhewn to him, that the only difference is in the ſize of the plant, the foreign being much ſmaller than ours: to which he adds, that, with reſpect to the gout, he ſuppoſes the ſoft down of this laſt, or indeed of any other plant, will anſwer the purpoſe full as well. [b]

Mullein (*Verbaſcum*) is a biennial plant, which periſhes ſoon after it has perfected it's ſeeds. The lower leaves of the common ſort, which is the ſpecies here ſpoken of as a weed, though it be that which is uſed in medicine, ſpread on the ground, are nine or ten inches long, and ſix broad, very woolly, of a yellowiſh white colour, and have ſcarce any footſtalks.* The ſtem riſes four or five feet high, and the upper part of it is garniſhed with yellow flowers, which ſit very cloſe, and form a long thick ſpike. Theſe flowers have an agreeable odour. They appear in July, and the ſeeds ripen in autumn. This plant is moſt common by the ſides of high-ways, and on banks: but if it once gets into fields in a warm expoſure, and is ſuffered to ſeed there, it will ſoon over-run the whole ground. It may eaſily be deſtroyed, by cutting off the ſtem when it is in flower.

Nettle (*Urtica*). The larger ſort of this well known ſtinging weed is perennial, and the ſmaller ſort is annual. Tolerably good cordage has been made of the threads or filaments of this plant, treated as hemp. They are ſtrong and tough, and

dio quinquefolio: Sp. Plant. 348. Mugwort with plain cut leaves, ending in many parts, wooly underneath, with ſingle ſpikes of flowers, which are oval, and the rays compoſed of five florets. It is alſo C. Bauhin's *Artemiſia vulgaris major*, Common great Mugwort.

[b] *Gardener's Dict.* Art. ARTEMISIA.

* This is Bauhin's *Verbaſcum mas latifolium luteum*, Great white Mullein, Hig-taper, or Cows-lungwort.

certainly

certainly afford great room for farther improvements of that kind, well deſerving the attention of the curious, who direct their inquiries to objects of public utility. Cutting it up by the root, before it can ſeed, is the way to deſtroy it.

Silver weed or *wild Tanſey* (*Potentilla*) is a ſpecies of cinquefoil* which grows naturally upon cold ſtiff land in moſt parts of England, and is a ſure mark of the ſterility of the ſoil. It's ſtalks ſpread upon the ground, and ſend out roots from their joints; by which means, and by the frequent ſhedding of it's ſeeds, for it flowers during the whole ſummer, it ſoon over-runs, and fills the land to a great diſtance. The leaves of this plant are compoſed of ſeveral lobes or wings, which are generally placed along the mid-rib, and terminated by an odd one: they are jagged at their edges, and are of a ſilvery colour, eſpecially on their under ſide. The way to deſtroy this kind of growth has been already pointed out. Mr. Ray ſays, that the root of wild tanſey, which is ſomewhat of the parſnip kind, is good to eat, and that hogs are very fond of it.

Thiſtle (*Carduus.*) Wherever this grows naturally, it is a ſure ſign that the land is ſtrong: but at the ſame time it is a great annoyance to every plant intended to be cultivated. This weed is too well known to need any deſcription. The beſt way to deſtroy it is to cut it up by the roots before it's ſeeding time, which is in the autumn; for cutting of it too young, will only make it branch the more: or, which Mr. Liſle prefers,[a] to pluck the thiſtles up by hand, when the ground is reaſonably moiſt, before they are grown to the ſize at which

* It is Tournefort's *Pentaphylloides argenteum alatum, ſeu Potentilla. Inſt.* 298.

[a] *Obſervations in Huſbandry, Vol.* II. *p.* 293.

they

they are uſually cut. They may then be eaſily drawn up with their roots, by the thumb and two fingers; and the weeder may guard againſt their prickles by putting on a glove, or falſe fingers, made of hard leather. Chalking of land is a good way to deſtroy this very noxious growth: but thorough tillage, ſummer fallows, and repeated good harrowings, are the moſt effectual of all.

By an excellent regulation in France, a farmer may ſue his neighbour who neglects to thiſtle his land at the proper ſeaſons, or may employ people to do it at the other's expence.[b] And it were to be wiſhed, that a ſimilar law was enacted here, to prevent the wide-ſpreading miſchiefs occaſioned by the ſeeding of this pernicious weed; among which may be reckoned, beſides it's choaking the young corn, that if wheat, in particular, be not well thiſtled, the reapers take up the grips ſo tenderly, leſt they ſhould prick themſelves, that, by their looſe handling of them, they ſometimes leave upon the ground corn enough to ſow the whole field.

Of the weeds propagated by their ſeeds, which ripen either before or with the corn, and which ſow themſelves, or are gathered with it, the following are moſt to be feared.

Chickweed (the common), which Botaniſts diſtinguiſh by the name of *Alſine*, though but an annual plant, will ſoon become very troubleſome, if it be ſuffered to ſtand till it ſheds it's ſeeds, which Mr. Liſle thinks[k] it will do ſeveral times in the year: for he obſerved on the 23d of October, a great deal of this weed, the branches of which carried many buds of bloſſoms, many flowers full blown, and many pods with white ſeeds almoſt

[b] *Maiſon Ruſtiques, Tom.* I. *p.* 640.
[k] *Obſervations in Huſbandry, Vol.* II, *p.* 312.

ripe;

ripe; ſo that it's increaſe can be the leſs guarded againſt by any ſort of huſbandry in thecommon way. The repeated horſe-hoeings in the new huſbandry, muſt here be attended with great advantage; and, at all events, particular care ſhould be taken, to prevent the ſeeding of this plant upon dunghills, where it is too often ſuffered to grow un-noticed, and undiſturbed: for it's ſeeds ſcattered there, and intermixed with the dung, will ſoon give birth to a multitude of weeds in the land upon which it is ſpread; unleſs it be kept, as indeed all dung uſed for manure ought to be, till it is thoroughly rotted, and the ſeeds have loſt their vegetative power.

Charlock (Raphanus,) the young plants of which are ſo very like thoſe of young turneps, as not eaſily to be diſtinguiſhed, but by the taſte; the charlock being hot and bitter, and the turnep mild. Farmers ſhould therefore be very careful in the weeding of their turneps, leſt they rear or pluck them up indiſcriminately. Mr. Liſle obſerves, [n] that cold wet lands are always more ſubject to charlock than white land; becauſe ſays he, the charlock ſeed, being very oily, reſiſts putrefaction, and is not eaſily opened or penetrated by moiſture; whereas white and light earth is ſoon dry after rain, and the water does not continue long enough on it to make ſuch ſeed germinate ſo effectually as in the other. By an experiment which he made, of ſowing charlock ſeed and turnep ſeed at the ſame time, he found that the turneps will appear in three days, and the charlock not in leſs than ten. This hint may be very uſeful to the huſbandman. Mr. Mortimer, after remarking [o] that both the white and the yellow charlock, which he calls carlic, are very prejudicial to corn, and that ſome lands are very

[n] *Obſervations in Huſbandry, Vol.* II. *p.* 297.
[o] *Art of Huſbandry, Vol.* I. *p.* 311.

ſubject

ſubject to it, eſpecially if manured with cow-dung alone, which, he thinks, increaſes it more than any other manure, unleſs it be mixed with horſe-dung, or ſome other hot manure; mentions his being told, that a perſon who had vaſt quantities of this weed in a field of barley, mowed the whole when the charlock was in flower and ready to ſeed, which is commonly about the middle of May, as low as he could, without taking off more than juſt the tops of the blades of the barley, and that this killed the charlock, and gave the corn an opportunity to get above it, in ſuch a manner, that he had four quarters of barley on an acre. He adds, that where a fallow is full of charlock, it will be right to turn in ſheep, for that they will eat it very readily: and Mr. von Döhren, of Hamburgh, informs me, that it is common in Holſtein to give charlock to horſes, either green, dried, or it's ſeeds mixed with oats; that thoſe cattle are fond of it and that it is found to be a very heartening food.

Cow-wheat, (*Melampyrum*,) by ſome called *Fox-tail*, * is a pernicious weed in many countries. It's ſeed is ſomewhat like wheat, and, according to Cluſius, ſpoils the meal with which it is ground, by giving it a dark colour and a bitter taſte: though Mr. Ray ſays he never could perceive any diſagreeable reliſh in the bread with which it was mixed, Mr. Miller ſays [1] it is a delicious food for cattle, particularly for fattening of oxen and cows, and that it may be worth while to cultivate it for this purpoſe. It's ſeeds ſeldom grow the firſt year, unleſs they chance to be ſown, or to ſow themſelves, in the autumn, ſoon after they are ripe.

* Which is C. Bauhin's *Melampyrum purpuraſcente coma*, or Cow-wheat with purpliſh tops.

[1] *Gardener's Dict.* Art. MELAMPYRUM.

Devil

Devil in a buſh, or Fennel-flower (*Nigella*,) is a troubleſome weed among the corn in Italy, France, and Germany, where it abounds much more than in this country. It riſes with ſlender ſtalks, near a foot high, which ſometimes branch out at the bottom, and ſometimes are ſingle, garniſhed with a few very fine cut leaves, ſomewhat like thoſe of dill. It's flower is generally blue, and it's ſeeds are rough and black. This, together with their being nearly of the ſame ſize as the grains of wheat, renders it difficult to ſeparate them from the good corn, when they have been gathered with it; and when ground with it, they blacken the meal. As this plant is annual, it may be extirpated by rooting it out before it can ſeed, which commonly is in Auguſt.

Fenugreek (*Trigonella*,) though not common in the fields in England, abounds ſo much in ſome places, particularly in warm countries, as to be a troubleſome weed. It is an annual plant, which riſes with a hollow branching herbaceous ſtalk, a foot and a half high, garniſhed with trifoliate leaves placed alternately. Theſe leaves are indented on their edges, and have broad furrowed foot-ſtalks. The flowers, which are white, and of the butterfly kind, as botaniſts term it, come out ſingly at each joint from the wings of the ſtalk, to which they ſit very cloſe. Theſe are ſucceeded by long compreſſed pods, ſhaped ſomewhat like a broad-ſword, ending in long joints, with a broad membrane on one edge, and filled with ſquare yellow ſeeds, indented on one ſide like a kidney. The whole plant has a very ſtrong odour, and it's ſeeds ripen in Auguſt, if the ſummer has been warm. The ſpecies of this plant which C. Bauhin diſtinguiſhes by the appellation of *Fænum Græcum ſativum*, is cultivated in the South of France, and in Germany, from whence ſuch quantities

tities of the ſeeds are imported here annually, that Mr. Miller thinks it might be worth while to try to propagate it in this country: to which end he gives pretty ample directions in his Gardener's dictionary.[p] Theſe ſeeds give a bad taſte to the corn they are ground with.

The ſort of *Groundſel* (*Erigeron*) which is looked upon as a weed, is a ſmall annual plant, ſeldom viſible during more than two or three months in the year. It comes to maturity in about a month, ſows itſelf, and dies; ſo that, like all other weeds of this claſs, whoſe ſeeds ripen either before or with the corn, and which ſow themſelves, it is eaſily extirpated by preventing it's ſeeding.

Hare's foot Trefoil (*Trifolium arvenſe humile ſpicatum, ſive lagopus*) abounds moſt in dry gravelly land, and is a ſure indication of the ſterility of the ſoil; for it is rarely ſeen upon good ground. It is an annual plant, whoſe root decays ſoon after it has perfected it's ſeed; and ſo coarſe, that cattle ſeldom eat it. Mr. Liſle obſerved ſome ridges ſo peſtered with this baſtard kind of clover, that he thought it as bad a weed as any he had ſeen that year[q]. Another ſpecies of Trefoil which is apt to infeſt arable land in many parts of England is diſtinguiſhed by the name of *Strawberry Trefoil* *, and has trailing ſtalks which put out roots at their joints. The leaves ſtand upon long ſlender foot-ſtalks; the lobes are roundiſh, and ſawed on their edges; the flowers are collected in roundiſh heads, ſtanding upon ſlender foot-ſtalks, which riſe from the wings of the ſtalks; and theſe have bladder empalements which terminate in two teeth. When they lie on the ground, their globular heads, hav-

[p] Art: Trigonella. [q] Vol. II. *p.* 313.

* This is the *Trifolium capitulis ſubrotundis, calycibus inflatis bidentatis reflexis, caulibus repentibus. Hort. Cliff.* 373. and C. Bauhin's *Trifolium fragiferum friſcum*, or Strawberry Trefoil.

ing

ing a little bluſh of red on their upper ſide toward the ſun, and the other part being white, look not unlike Strawberries; and from thence this kind derives it's particular name[r].

Melilot (*Melilotus*) commonly uſed in medicine, is of the trefoil kind †, and grows in ſuch abundance among the corn in many parts of England, particularly in Cambridgeſhire, as to be a moſt troubleſome weed; for it is hardly poſſible to ſeparate it from the corn in reaping, ſo that they are houſed together, and the ſeeds of the melilot, which ripen about the ſame time as the corn, are threſhed out with it, after which, they being likewiſe heavy, it is very difficult to ſeparate them. If but a few of theſe ſeeds are ground with the corn, they will ſpoil the flower; for the bread, or whatever elſe is made with it, will have a ſtrong taſte and ſmell, like melilot plaſter. The roots of this plant are ſtrong and woody, and from them ſpring out ſeveral ſtalks which riſe from two to four feet high, according to the goodneſs of the land. Theſe ſtalks branch out, and are garniſhed with trifoliate leaves, having oval ſawed lobes of a deep green colour. The flowers are produced in long ſlender ſpikes, which ſpring from the wings of the ſtalks. They are of a bright yellow, ſhaped like the other butterfly flowers, and are ſucceeded by naked ſeeds which ripen in Auguſt.

Spurrey (*Spergula*) is a common weed in many parts of England. It ſeldom riſes above ſix inches high, flowers in the beginning of July, ripens it's ſeeds in Auguſt, and is an annual plant. The way to extirpate it is conſequently by ſummer fallows,

[r] MILLER's *Gardener's Dict.* Art. TRIFOLIUM.

† It is the *Trifolium leguminibus racemoſis nudis diſpermis; caule erecto. Hort. Cliff.* 376. Trefoil with long naked bunches of pods containing two ſeeds, and an erect ſtalk; which is C. Bauhin's *Melilotus officininarum Germaniæ*, common Melilot.

and

and cutting it off before it can ſcatter it's ſeeds, which are very ſmall. Two ſpecies of this plant* are cultivated in Holland and Flanders, for the winter food of cattle, when there is a ſcarcity of graſs. It is ſaid to enrich the milk of cows ſo as to make it afford excellent butter; and the mutton fed on it is frequently preferred to that which has been fed on turneps. Hens too eat this herb greedily, and it is commonly thought to make them lay an extraordinary number of eggs: From the lowneſs of it's growth, this plant cannot afford a very great quantity of fodder; but as it will grow on the pooreſt ſand, where no other graſs will thrive ſo well, it may be cultivated to good advantage in many places; and by feeding it off the ground, the dung of the cattle will improve the land. The people in the Low-Countries commonly ſow it twice a year; the firſt time in April or May, to be in flower in June and July; and the ſecond time after rye-harveſt, to ſerve their cattle in November and December. The uſual allowance with them is about twelve pounds of ſeed to an acre of land.

Wild-garlick, *Crow-garlick*, or *Cow-garlick*, as ſome call it (*Cepa*), will do great damage to corn in dry ſandy grounds, but will not grow in clays, according to Mr. Liſle, who mentions [a] a farmer in ſome of whoſe fields it grew in ſuch abundance, that his wheat taſted ſtrong of it, and was thereby damaged from ſix-pence to a ſhilling in the buſhel.

* Namely the *Spergula foliis verticillatis, floribus decandris, Hort Cliff.* 173. Spurrey with leaves in whorls, and flowers with ten ſtamina, which is C. Bauhin's *Alſine Spergula dicta major*, Greater Chickweed called Spurry; and Linnæus's *Spergula foliis verticillatis, floribus pentandris*, Spurrey with whorled leaves, and flowers with five ſtamina; or Tournefort's *Alſine ſpergulæ facie minima ſeminibus emarginatis*, The leaſt Chickweed with the appearance of Spurrey, having bordered ſeeds.

[a] *Obſervation in Huſbandry, Vol.* II. *p.* 313.

Wild-

Wild-oats are difficult to be extirpated where they have once taken poſſeſſion; for, ripening before harveſt, and ſcattering their ſeed around them, they will remain in the ground till it is plowed up again, though it be for a whole year, ſome ſay four or five years, and will then come up with the corn. The ſureſt way to deſtroy them, is, to lay the ground down to clover, and to mow the oats and clover together before the oats are ripe. Their roots will not ſhoot out again.

Wild-poppy, or *red-weed* (*Papaver erraticum*,) common in almoſt all arable lands, but moſt ſo in the lighteſt, and conſequently pooreſt, is an annual, which ſometimes multiples ſo prodigiouſly by it's ſeeds, that it choaks the wheat among which it grows. The ſorts moſt frequent in our corn fields are, 1. The common red poppy, which riſes about a foot and an half high, with ſeveral rough branching ſtalks garniſhed with hairy leaves five or ſix inches long, deeply jagged almoſt to the mid-rib, and which flowers in June: 2. A ſmaller kind with leaves cut into much finer ſegments, ſlender ſtalks, little more than a foot high, not ſo branching as the former, and ſmaller flowers, of a deeper red, which likewiſe appear in June: and 3, a ſmaller ſort than either of the former, with copper coloured flowers, which appear in May. The flowers of all theſe are ſucceeded by oblong prickly heads, filled with ſmall black ſeeds, which ſow themſelves if they are ſuffered to ſtand.

Wild-vetches (*Vicia ſegetum*) are great enemies to corn wherever they prevail, and eſpecially if it happens to be lodged: for they then ſoon get above it, keep it down, and thereby contribute greatly to it's rotting. Too much care cannot be taken to extirpate them, by preventing their ſeeding.

Upon

Upon the whole, it may be looked upon as a general rule, that ſowing of clean ſeed, and laying the ground down to graſs, will at length overcome all ſorts of weeds; and the more in heart the land is laid down to graſs, the thicker the graſs, or clover, will grow, and the better effect it will have.

SECT. II.

Of Quadrupeds, Birds, Vermin, and Inſects; as enemies to Corn.

AMONG the quadrepeds, birds, and vermin, which do miſchief to the ſtanding corn, moſt writers upon Agriculture reckon hares and rabbits. Mr. Liſle obſerved particularly in a field of barley, ſo many full-grown ears lying withered along a track in the field, that, thinking it a great ſpoil, and deſirous to know what had occaſioned it, he took them up, and found that hares had bitten the ſtraws off at the ground, to make themſelves a more convenient paſſage[a]. Rabbits frequently do much greater hurt: ſo that the farmer can hardly have a corn-field worſe ſituated, than in the neighbourhood of a warren. In hard winters eſpecially, they will go a great way to feed upon his green corn.

Moles are very pernicious enemies to all huſbandry, by looſening of the earth, and deſtroying the roots of corn, graſs, and other vegetables.

The common way of deſtroying them, particularly in the ſouthern parts of England, is by traps which fall on them, and ſtrike ſharp tines or teeth through them. But a better inſtrument for this

[a] *Obſervations in Huſbandry, Vol.* II. *p.* 390.

purpoſe is thus deſcribed by Mr. Mortimer [b], who has copied it from Mr. Worlidge [c].

Take a ſmall board, about three inches and a half broad, and five inches long: on one ſide thereof raiſe two ſmall round hoops or arches, one at each end, like the two hoops or bails of a carrier's waggon, capacious enough for a mole to creep through eaſily: in the middle of the board make a hole about the bigneſs of a gooſe-quill, and have in readineſs to put into it a ſtick about two inches and a half long, fitted at one end to the hole, and a little forked at the other. Cut alſo a hazel or other ſtick, about a yard, or a yard and a half long, which will riſe with pretty ſtrong elaſticity, when it is ſtuck into the ground; and to the end of this ſtick faſten a very ſtrong nooſe of horſe-hair, made ſo as to ſlip eaſily. Have likewiſe in readineſs four ſmall hooked ſticks: then go to the furrow or paſſage of the mole, and after you have opened it, fit in the little board with the bended hoops downward, ſo that when the mole paſſes that way, it may go directly through the two ſemi-circular hoops. But before you fix the board in this manner, put the hair ſtring through the hole in the middle of it; place the nooſe in a circular form, ſo as to make it anſwer to the two hoops; put the ſmall ſtick before mentioned gently into the hole in the middle of the board, ſo as juſt to ſtop the knot of the hair ſpring, without entering ſo far as abſolutely to tighten it. Then faſten the board down with four hooked ſticks, and cover it with earth. When the mole, paſſing in it's furrow, comes into this trap, it will diſplace the ſmall ſtick that hangs perpendicularly downward, the knot will then be drawn through the

[b] *Art of Huſbandry, Vol.* I. *p.* 315.
[c] *Syſtema Agriculturæ, p.* 216.

hole

hole, and the nooſe, inſtantly ſtreightened by the riſing of the end of the hazel ſtick to which it is faſtened, which will catch the mole round the neck.

Others, watching their motions in the morning and evening, which are their uſual times of ſtirring, dig them out in a moment with a ſpaddle: and about March, which is their time of breeding, numbers of their young ones may be deſtroyed by turning up their neſts, which are generally in the greateſt hills; and the old ones who come to ſeek their young will preſently be taken.

Some commend the pot-trap, which is a deep earthen veſſel ſet in the ground with the brim even with the bottom of the mole-tracks. The ſeaſon for uſing this is when the moles couple, which is about the beginning of March, or perhaps ſomewhat earlier.

Mr. Worlidge ſays,[d] they may be driven from gardens, meadows, and other places where one would not chooſe to dig, by fuming their holes with brimſtone, garlick, or other unſavoury things; and that the putting a dead mole into a common haunt, will make them abſolutely forſake it: to which Mr. Mortimer adds[e], but only upon report, that white hellebore and the roots of palma-chriſti, dried, powdered, and ſifted through a fine ſieve, then mixed with barley-meal and eggs, and worked into a paſte with wine and milk, will kill them, if laid in little pellets under their hills.

Almoſt every countryman is experimentally ſenſible of the great injuries done by rats and mice, not only to the corn laid up in ſtacks, barns, and granaries, but alſo to that in the field, where theſe vermin, and particularly the field mice, multiply to ſuch a degree in ſome places, that it is hardly poſſible to deſtroy them. The means of

[d] *Syſtema Agriculturæ, p.* 217.
[e] *Art of Huſbandry, Vol.* I. *p.* 317.

hindering them from preying upon corn in the ſtack, have been already pointed out*; and the means of guarding againſt them in barns and granaries will be noticed hereafter.

As to birds, it is generally allowed, that rooks and ſparrows deſtroy much more corn than pigeons; though ſome complain grievouſly even of theſe laſt. Rooks are undoubtedly great annoyances to it, at ſeed-time, by pulling it up whilſt it is young, and by feeding on it alſo at harveſt. According to Mr. Liſle[a], they will not pull up the ſpring or lent-corn till ſeed time is over, and there is not grain for them; nor do they much care for peas in the grain, or for barley, ſo long as they can come at oats: for the oat ſtripped of it's huſk is much ſweeter and tenderer than barley: but when it comes up into blade, they will fall moſt on barley, which is ſowed later, is a fuller bodied grain, and has more flour left in it, than the oat. When they attack barley in the ear, it generally is in light hollow ground, where the corn is looſe at the root. "If peas were ſowed late, continues he, "they would doubtleſs fall on their blade, and "pull them up, rather than other corn, becauſe "of the bulk of their grain, in which there is "more flour to be found unexhauſted: and I do "remember, they fell on goar-vetches which were "ſowed in May, with ſuch voraciouſneſs, that it "was very hard to ſecure half of them. In ſome "grounds, which they take to, one may gather a "handful of blades pulled up by them in the "compaſs of a yard." They do moſt harm when the ſnow is firſt going off from the green wheat, towards the end of winter: for having been pinch-

* See *Vol.* I. *p.* 404.

a *Obſervations in Huſbandry, Vol.* II. *p.* 393.

ed

ed for food during that ſeaſon, they then greedily pluck up the young plants, in order to come at the remainder of the ſeeds ſtill adhering to their roots; and are greatly aſſiſted in this by the looſe ſtate of the earth at that time.

Among the many contrivances to frighten them away, ſuch as feather's ſtuck up, the limbs of rooks ſcattered about the ground, dead rooks hung on ſticks, the gun, a boy to halloo and throw his hat, or to toſs a dead rook up in the air, Mr. Tull ſays he found this laſt to be the moſt effectual. They will immediately quit their uſual places of abode, if the earth is turned up around the trees, in which they have built their neſts, and will not return to them 'till the graſs is grown again; as was lately experienced in the repairing of Fountain-court in the Temple: and Mr. Liſle aſſures us [a], that the taking down of their neſts, with their young ones in them, and burning under the trees they were built in, will effectually make all the old ones deſert that place. However, it has been doubted, and perhaps with reaſon, whether they do not, upon the whole, compenſate pretty fully, for the miſchief they do to corn, by deſtroying vaſt quantities of grubs, worms, and other pernicious inſects, in the ſpring: as crows are alſo of ſervice in the neighbourhood of popular towns, by devouring a great deal of carrion.

It is a common proverbial ſaying of the countrymen, that at whatſoever farm a colony of rooks plant themſelves, and make a rookery, it is a ſign of proſperity to the occupier of that land; and that, on the contrary, their deſerting it, betides misfortunes and poverty: for both which remarks, Mr. Liſle accounts very rationally, by obſerving [b], that where a man is a good huſbandman to his

[b] *Ibid. p.* 396. [a] *Ibid. p.* 397.

land, and improves it, the worms, which are a great food to theſe creatures, eſpecially at certain times of the year, multiply, and grow to a much greater bulk and fatneſs, than in a poor neglected ſoil; the ſtrength of land being as diſcernable by the large ſize of worms, as from the growth of plants; and that the grubs or maggots of the beetle kind in particular, on which the rooks feed greatly, as is apparent from their following the plough, in order to pick them up, not only grow fatteſt and largeſt in rich well tilled ground; but that the beetles themſelves, while in their ſtate of flies, always chooſe to lay their eggs in ſuch land as will beſt nouriſh and provide for their young. The contrary to this ſoon happens under a bad husbandman.

Sparrows, though but ſmall, are a very numerous generation of corn-eaters, and make ſad havock among it at harveſt-time, eſpecially near hedges and villages. Bearded-wheat, barley, and rye, are leſs their prey than any other grain: a circumſtance which may be worth the farmer's attending to in places where his land lies near to their uſual haunts; for it is better to have a full crop, even of rye, than to have half a crop of wheat eaten by them, after it has been raiſed with great care. As they are eaſily allured to any particular ſpot baited for this purpoſe, eſpecially in hard weather in the winter, and in ſummer before the corn is ready for them, at both which times their food is ſcarce abroad, and they then flock to ſtacks and barns, dozens of them may be taken at a time with the large folding ſparrow net.

M. Duhamel is a pretty ſtrong advocate for partriges and pigeons, the former of which, only nip off the tips of the young blades of corn, without ſcratching or digging for the ſeeds, and conſequently cannot do any great hurt, unleſs they

they are extremely numerous; and the latter, he thinks [b], neither feed upon the green corn, nor have bills ſtrong enough to ſearch for it's ſeeds in the earth; but only pick up the grains that are not covered, which would infallibly become the prey of other animals, or be dried up by the ſun. "From the time of the ſprouting of the corn, "ſays he, pigeons live chiefly upon the ſeeds of "wild uncultivated plants, and therefore leſſen "conſiderably the quantity of weeds that would "otherwiſe ſpring up; as will appear from a juſt "eſtimate of the quantity of grain neceſſary to "feed all the pigeons of a well-ſtocked dove-"houſe." But Mr. Worlidge and Mr. Liſle allege facts in ſupport of the contrary opinion. The latter relates [c], that a farmer in his neighbourhood aſſured him he had known an acre ſowed with peas, and rain coming on ſo that they could not be harrowed in, every pea was fetched away in half a day's time by pigeons: and the former ſays [d], "It is to be obſerved, that where the flight "of pigeons falls, there they fill themſelves and "away, and return again where they firſt roſe, "and ſo proceed over a whole piece of ground, "if they like it. Although you cannot perceive "any grain above the ground, they know how to "find it. I have ſeen them lie ſo much upon a "piece of about two or three acres ſown with "peas, that they devoured at leaſt three parts in "four of the ſeed, which, I am ſure, could not be "all above the ſurface of the ground. That "their ſmelling is their principal director, I have "obſerved; having ſown a ſmall plat of peas in "my garden, near a pigeon-houſe, and covered

b *Elements d'Agriculture, Liv.* II. *C.* 7. *Art.* 2.
c *Obſervations in Husbandry. Vol.* II. *p.* 392.
d *Syſtema Agriculturæ, p.* 219.

" them ſo well that not a pea appeared above
" ground. In a few days, a parcel of pigeons
" were hard at work in diſcovering this hidden
" treaſure; and in a few days more I had not
" above two or three peas left out of about two
" quarts that were planted; for what they could
" not find before, they found when the buds ap-
" peared, notwithſtanding they were hoed in, and
" well covered. Their ſmelling alone directed
" them, as I ſuppoſed, becauſe they followed the
" ranges exactly. The injury they do at harveſt
" on the peas, vetches, &c. is ſuch that we may
" rank them among the greateſt enemies the poor
" husbandman meets withal; and the greater,
" becauſe he may not erect a pigeon-houſe, where-
" by to have a ſhare of his own ſpoils; none but the
" rich being allowed this privilege, and ſo ſevere
" a law being alſo made to protect theſe winged
" thieves, that a man cannot encounter them, even
" in defence of his own property. You have
" therefore no remedy againſt them, but to af-
" right them away by noiſes, or ſuch like. You
" may, indeed, ſhoot at them; but you muſt not
" kill them; or you may, if you can, take them
" in a net, cut off their tails, and let them go;
" by which means you will impound them: for
" when they are in their houſes, they cannot bolt
" or fly out of the tops of them, but by the
" ſtrength of their tails, after the thus weakening
" of which, they remain priſoners at home."

Mr. Worlidge's impounding the pigeons re-reminds me of a humourous ſtory of a gentleman who, upon a neighbouring farmer's complaining to him, that his pigeons were a great nuiſance to his land, and did ſad miſchief to his corn, replied jokingly, pound them, if you catch them treſpaſſing. The farmer, improving the hint, ſteeped a parcel of peas in an infuſion of *Coculus Indicus*, or

ſome

ſome other intoxicating drug, and ſtrewed them upon his ground. The pigeons ſoon ſwallowed them, and ſoon remained motionleſs on the field: upon which the farmer threw a net over them, incloſed them in it, and carried them to an empty barn, from whence he ſent the gentleman word, that he had followed his directions about the pounding of his pigeons, and deſired him to come and releaſe them.

Mr. Mortimer recommends [e] as a means of hindering birds from eating of new-ſown corn, to ſprinkle lime or ſoot upon it: and he rightly obſerves, with Mr. Worlidge [f], that moiſt and warm lands, which are uſually the moſt fertile, are the moſt ſubject to vermin in general.

Ants and piſmires, which are reckoned among the peſts of the field in hot countries, ſuch as Italy, Spain, and the Weſt-Indies, do much leſs injury here to corn-fields, than to paſture-lands and gardens; under which laſt heads the means of deſtroying them will therefore be ſpoken of: as will alſo, for the ſame reaſons, what relates to the guarding againſt ſnails and ſlugs, two ſpecies of vermin, which, eſpecially in wet years, frequently kill a great deal of corn, by eating it off at the roots.

The grub or large maggot, which ſome call the rook-worm, becauſe rooks are particularly fond of it, and which often does conſiderable injury to corn, by under-mining it, and preying upon it's roots, is that which produces the beetle, and is beſt extirpated by good and frequent plowing. This, let the land be ever ſo much infeſted with that inſect, will clear the ground of it, at leaſt for ſome years.

e *Art of Huſbandry, Vol.* I. *p.* 322.
f *Syſtema Agriculturæ, p.* 221.

Worms

Worms are very prejudical to land, by eating the roots both of corn and graſs, eſpecially when the corn begins firſt to ſhoot. Mr. Worlidge ſays [g], that a ſtrong lie made of the aſhes or fixed ſalts of any vegetable, will not only deſtroy them, but prove at the ſame time an extraordinary enricher of the ground: and Mr. Mortimer, after confirming this, adds [h], that he believes ſea-water would be a very great improvement of ſuch lands near the ſea, as are troubled with them. He once ſowed ſoot upon a piece of very rank clay which was greatly infeſted with worms, and thereby killed ſeveral buſhels of them: but he likewiſe tried ſoot upon other clayey lands, and upon other ſoils, without finding the ſame effect. Whether this was owing to the difference of the ſoil, to the ſeaſon in which he did it, or to the land's having been ſooted before, he could never determine. Some commend chalk and lime, as very powerful to deſtroy them. The winter fallowing of land in a wet time, when the worms come up to the ſurface of the ground, is alſo very good to kill them; eſpecially if a few nails with ſharp heads are driven into the bottom and ſides of the plough, which will then cut them to pieces. Water in which walnut leaves have been ſoaked for a fortnight or three weeks, till it is very bitter, will kill them: but this cannot be practiſed in corn fields, as it may in gardens: though it may, perhaps, be worth while to try what effect ſteeping of the ſeed corn in a liquor of this kind will have, not only as a preſervative againſt worms and other inſects; but even, perchance, againſt the ſmut, or other diſtempers.

Hurtful as many of the above enemies to corn frequently are, they often do it ſtill leſs injury than

[g] *Ibid.* [h] *Art of Huſbandry, Vol.* I. *p.* 323.

ſeveral

ſeveral ſmall inſects, ſome of which are ſo very minute as ſcarcely to be noticed by the farmer.

Among others, a ſmall kind of worm gets into the roots, chiefly of oats, and, working upward, deſtroys all the inſide of the plant, which periſhes ſoon after. M. Duhamel ſuſpects it to have been an inſect of this kind that deſtroyed vaſt quantities of wheat in the neighbourhood of Geneva, and of which M. de Chateauvieux ſent him the following account. "Our wheat ſays that illuſtrious "husbandman [1], in the month of May 1755, "ſuſtained a loſs which even that cultivated ac- "cording to the new husbandry did not eſcape. "We found in it many little white worms, which "afterwards became of a cheſnut colour. They "poſt themſelves between the blades, and eat the "ſtems. They are uſually found between the firſt "joint and the roots. Every ſtalk which they "attacked, grew no more, but became yellow, "and withered. The ſame misfortune befel us "in the year 1732. Theſe inſects appeared about "the middle of May, and made ſuch havock that "the crop was almoſt deſtroyed."

Mr. Liſle mentions [2] that, on the 13th and 14th of June, in pulling up wheat in ear, and ſow thiſtles, he obſerved among the upper part of the roots of moſt of theſe plants, knots or cluſters of graſs-lice, or green locuſts, as he calls them, which appeared whitiſh when they were but juſt come to their ſhape, and as yet under ground: and among moſt of theſe cluſters he obſerved a fly at her incubation, very turgid of a whitiſh matter; ſhe being then blowing theſe inſects. Her wings were black, and he thought her plainly the ſame

1 DUHAMEL, *Traité de la Culture des Terres, Tom.* IV. *p.* 316. and *Eléments d'Agriculture, Tom.* I. *p.* 299.

2 *Obſervations in Huſbandry, Vol.* II. *p.* 402.

as the locuſt, excepting that it had wings. He did not find more than one fly at any one root.

We too often find, in our kitchen-gardens, a ſort of vermin called vine-fretters. They fix upon the roots of leguminous plants, which afterwards gradually turn yellow, and die. M. Tillet ſays he has obſerved the ſame inſect in the roots of wheat.

The cuckow-ſpit, or ſpring-forth, as it is commonly termed, lodges itſelf principally in the joints of plants, ſeldom appears before the latter end of May, and is moſt common when rain has fallen after a ſeries of dry weather. M. Poupart, in his account of this little creature [b], ſays, that as ſoon as it is out of it's egg, it goes to a plant, which it touches with it's fundament, and faſtens there a white drop of liquor full of air; that it drops a ſecond near the firſt, then a third, and ſo on till it covers itſelf all over with a ſcum or froth, which keeps it from the heat of the ſun, or ſpiders that would ſuck it: But Mr. Liſle [c] takes this liquid to be nothing but the nightly dew, which falls on the fork or joint of the plant, where the little inſect works it into froth with its proboſcis, as with a bellows.

M. Duhamel has frequently noticed, and made drawings of, a ſpecies of ſmall inſects, ſome of a bright red, and others black, which are found in great numbers in the ears of wheat. He ſuſpected that they fed on a ſweetiſh juice which is in the ear whilſt green: and M. Tillet, who was immediately of opinion that they might do conſiderable damage to the grain, followed them very aſſiduouſly in all their metamorphoſes, of which he has given a full account in the memoirs that gained

[b] *Journal des Scavans pour le mois d'Avril*, 1707.
[c] *Ubi ſupra.*

the

the prize of the Accademy of Bordeaux for the year 1755.

The inhabitants of a conſiderable part of the province of Angumois have, for thirty years paſt, ſuſtained an hitherto irreparable loſs, by an inſect which begins to devour their corn even in the ear, before it is reaped. This ſcourge deprives them annually of their moſt promiſing crops. It appeared at firſt only in a few hamlets, but ſoon made a rapid progreſs, and has now ſpread to the lands of upwards of two hundred pariſhes. Famine and the moſt fatal epidemic diſeaſes have often taken riſe from leſs beginnings. Meſſieurs Duhamel and Tillet were deputed by the Academy of Sciences at Paris, of which they are members, to enquire into the nature of this inſect, and the means of preventing and curing the dreadful calamity occaſioned thereby. They have jointly publiſhed a ſmall treatiſe on this ſubject [a], from whence I ſhall extract the following remarks ſo much the more readily, as their means of prevention and cure in this particular caſe may be equally applicable to the injuries done to corn by inſects in general.

This inſect is moſt generally known as a butterfly, very much like the moth which preys on woollen cloths, or the falſe moth which is found in great quantities in the granaries of all countries, and which feeds on corn. M. de Reaumur, whoſe accurate inquiries into nature nothing can eſcape, has minutely deſcribed both theſe inſects [*].

The butterflies which proceed from the wheat caterpillar are often ſmaller than the falſe

[a] *Hiſtoire d'un Inſecte qui devore les Grains de l'Angoumois.*

[*] In the 2d and 3d Volumes of his *Memoires pour ſervir à l'Hiſtoire des Inſectes.*

moth.

moth. Some of them are, however, larger, and longer ſhaped: but, that excepted, they are much like them: they are likewiſe of the claſs of four-winged *phalenæ* or night butterflies; their wings are long in proportion to their breadth, which is almoſt equal at the upper and the lower end. The colour of the upper wings varies; being ſometimes of a light, and ſometimes of a darkiſh grey brown, but always ſhining when expoſed to the ſun. The poſition of theſe wings, of which the edges are cloſe ſet with long hairs, is horizontal when the inſect firſt ſettles after having flown; but ſoon after thoſe edges incline downward. It's head (*PL. I. Fig.* 24, 25, 26.) is furniſhed with two *antennæ* (*Fig.* 27.) the joints of which, nicely fitted into each other, leſſen gradually up to the point. It's eyes are almoſt as large as thoſe of the falſe moth. Between the *antennæ* are two beards (*Fig.* 28.) which proceed from the lower part of the head and riſe up above it; and likewiſe between the *antennæ* is a tuft of hairs which turn up backward.

Theſe inſects do not take any food while they are in the ſtate of butterflies, as will be proved by ſeveral experiments; nor do, or indeed can they, prey upon and deſtroy corn during that time, as is the general, but miſtaken opinion in Angoumois; for they have not even organs capable of doing it the leaſt injury. Their only function then is to procreate their ſpecies.

The males of theſe butterflies ſeem, in general, to be larger than the females: but they cannot well be diſtinguiſhed with certainty, unleſs they are ſeen coupled together, which, according to the very nice and careful obſervations of Meſs. Duhamel and Tillet; never is but in the night time, or in a dark place. Their copulation then is like that of the ſilk-worm butterfly: the body of the male

male and that of the female then form one ſtrait line; their heads are turned different ways; the ends of their wings reſt upon each other; and their conjunction laſt ſeveral hours. The above-mentioned gentlemen, with many other witneſſes, ſaw great numbers of them in this ſituation, both upon heaps of corn in granaries, and upon ears of corn in the field. They catched two of them in the act of copulation, and put them into a glaſs covered over, where they then ſeparated, but were found joined together again the next day, in the evening.

As ſoon as the female is impregnated, ſhe lays her eggs in great numbers. Meſſieurs Duhamel and Tillet put a male and a female, coupled, into a glaſs veſſel, and, watching them carefully, ſaw the female, ſoon after her ſeparation from the male, depoſit her eggs, ſometimes on one ſpot and then on another, in heaps of 60, 80, or 90 together. Theſe eggs are ſquirted out, as it were, commonly by three, four, or half a dozen, and ſometimes thirty, at once; and at each ſquirt of this kind the female changes her ſituation. Thoſe which were incloſed in glaſſes caſt ſome of their eggs upon a few grains of corn depoſited at the bottom of thoſe glaſſes, and, finding themſelves cramped there, laid others on the ſides of the veſſel. Theſe eggs are accompanied with a viſcous matter which makes them ſtick to the places they are laid in; and this coheſion ſoon becomes very ſtrong.

Theſe eggs, as may eaſily be imagined from the ſize of the mother and the great number which ſhe lays, are ſo extremely ſmall that one of them would drop through a hole made in a bit of paper with the point of the fineſt needle. When examined with a miſcroſcope, they look, as in *Fig.* 4, not unlike the *nymphs* commonly called *ants eggs*.

They

They are ſtreaked length-wiſe, and appear rough or curdled. When firſt laid, they are white; and afterwards they become red, as if tinged with carmine; owing to the colour of the caterpillar within the egg, of which the ſhell is very thin and tranſparent, as is evident after the caterpillar has left it.

By means of the thinneſs and tranſparency of this covering, the caterpillar may be ſeen within the egg, as at *b*, *Fig.* 5. At firſt, it is bent as in *Fig.* 6: ſome time after, it wriggles itſelf into the ſituation repreſented in *Fig.* 7; and then it makes a hole through the end of the egg, and comes out there, as in *Fig.* 8. This opening remains at the end of the empty eggs, as at *c* in *Fig.* 5.

It is with great difficulty that the caterpillar gets it's two firſt legs out of the egg; but after it has extricated four or ſix of it's legs, it ſoon draws out the reſt of it's body. At it's firſt iſſuing from the egg, this caterpillar looks like a bit of hair about a quarter or a fifth part of an inch long.

Theſe caterpillers generally come out of their eggs on the ſixth or ſeventh day after they have been laid. Some ſay they have ſeen them hatch at the end of four days. The temperature of the air will undoubtedly influence this variation. They are red, as was ſaid before, whilſt in the egg; but that colour goes off by degrees after they are hatched, and they ſoon become almoſt white.

The female butterflies which are upon the ears of corn in a field endeavour to place themſelves in ſuch manner as to lay their eggs cloſe to the place where the grain is faſtened to the ſtalk. *Fig.* 1. repreſents ſome of them, at *a*, in the attitude of thus laying; in which caſe their eggs are depoſited near the bottom of the grains, toward the ſtalk: but it often happens that, in their hurry

hurry to lay, they ſcatter their eggs in other places, as repreſented upon the huſks in *Fig.* 2 and 3.

As ſoon as the caterpillars are hatched, they ſet about making their way into the grain, in order to feed upon it's flour. If the eggs have been laid in the granary, after harveſt, and upon the grains themſelves, they generally creep into the furrow *a* of the wheat (*Fig.* 9 and 10), and there weave a ſlight web *bb*. They then tear a hole in the ſkin or rind, range around them the particles of the bran thus ſeparated, and wriggle themſelves into the mealy ſubſtance which is to be their food. The hole through which the caterpillar entered can then no longer be perceived, but by a little heap of bran which lies upon it, as in *Fig.* 11. This ſmall quantity of pulveriſed bran, which is a ſure ſign that a young caterpillar has got into the grain, may eaſily eſcape the notice of thoſe who have not obſerved it before; but when once known, it is eaſily diſtinguiſhed.

When the eggs are hatched upon the ears, in the field, the young caterpillars ſoon find means to glide in between the chaff and the grain, and in that ſituation they pierce the latter, as was ſaid before, generally in the furrow, but ſometimes at the pointed end, which is a little hairy.

To ſet this in a yet clearer light, it is to be obſerved, that, in moſt kinds of wheat, three grains of corn adhere, or are faſtened, at the ſame height, to the ſpike or ſtalk which traverſes the ear, as at *bbb*, *Fig.* 1, in ſuch manner as to form a ſort of triangle, or flower-de-luce. Each grain is covered with three concave coats or huſks, the ſmalleſt and thickeſt of which is repreſented by *Fig.* 2 and 3: their inner huſk is covered by a broader, but thinner; and this again is covered by a ſtill larger, from which ariſes the beard, when

there is one, Over all theſe there frequently is a fourth tegument, or very thin membrane, more or leſs wide. All theſe huſks lap over each other like the ſcales of a fiſh, and envelop the grain. The end *e* (*Fig* 9.) is uppermoſt, and the end *f* reſts upon it's ſupporter. The germe is at the end *f*, and the extremity *e* is covered with a hairy down.

The young catepillar finds means to creep under all theſe ſcale-like coverings, and to get at the grain, which, after having wove a ſlight web of only a few fine threads, either to cover itſelf, or to hold by, it attacks, ſometimes at the upper end *e* (*Fig.*9), which is very ſoft in green corn; and ſometimes, if it has crept in at the lower end, it lodges in the longitudinal furrow of the grain, and there begins to mine in the manner before related.

As the huſks of barley are harder, and ſtick much cloſer to the grain, than thoſe of wheat, it is almoſt always at the point *d* (*Fig.*12.) that theſe caterpillars ſlip into that corn, by means of a ſmall opening generally perceptible in that part.

To conceive how theſe ſmall caterpillars, which are hardly able to pierce the rind or bran of wheat, can glide into barley by means of the opening before mentioned, it is neceſſary to conſider the organiſation of this grain. It is formed of two lobes *c c*, *Fig.* 12, which are partly ſeparated by a furrow in it's middle, and partly covered by a tegument *a a*, which ſits exactly cloſe and adheres ſtrongly to the lobes *c c*, and terminates in a long awn or beard *b*, of which only a part is repreſented in this drawing. The two lobes *c c* are again covered with their proper tegument, which ends in two ſmall appendices at *d*. Here generally is a chaſm or opening, through which the caterpillar penetrates to the mealy ſubſtance.

To

To trace this caterpillar in it's farther progreſs after it had crept in at this opening, and conſequently diſappeared; Meſſieurs Duhamel and Tillet tore off the appendices *d*, *Fig.* 13, and found, that after having wove a ſlender web, it had immediately begun to attack the lobes of the grain of barley, as was evident from the bran around it. After it had made it's way entirely into the grain, and was buried there, they ſaw nothing but the little heap of bran it had thrown up, over the hole through which it entered.

Notwithſtanding the induſtry of this inſect, it ſeems highly probable that the young ones meet with great difficulties in their attempts to get into the grain; ſince very many of them die before they can effect a lodgment in the mealy ſubſtance. This number is ſo great, that it might induce one to wonder how ſuch quantities of corn can be deſtroyed by theſe caterpillars, if one did not conſider the vaſt fecundity of the female butterflies. But the ſequel of this account will ſhew, that if prodigious numbers of them did not periſh, it would hardly be poſſible to ſave a ſingle grain of any kind of corn.

The people of Angumois were ſtrongly of opinion that the miſchief occaſioned by this inſect was peculiar to the corn of their country, and that what was brought to them from other places always eſcaped unhurt. To clear up this point, Meſs. Duhamel and Tillet put into different glaſſes wheat of the growth of other provinces, and with the grains, in each glaſs, ſome of theſe butterflies actually coupled. They ſoon ſaw the female lay her eggs upon theſe grains, and afterwards beheld the caterpillars hatch, and make their way into the grains. Their farther obſervations proved, that the principal cauſe of the ſpreading of this evil is, that the inſect itſelf, which multiplies exceedingly,

is conveyed to other parts with the corn in which it is incloſed.

The caterpillar incloſed in a grain of corn preys upon the mealy ſubſtance of that grain, till it has eaten it all; by which time the inſect has attained it's full growth. Whenever a grain was opened (*Fig.* 19.) in which the caterpillar was not full grown, a great deal of flour yet remained: but when this inſect was full-grown, there remained only the ſkin, or bran, ſo deſtitute of flower, as not even to diſcolour clear water. Hogs, though very greedy creatures, and fond of bran, would not touch theſe hulls when given to them unmixed; but they eat them readily enough when mixed with other food.

M. de Réaumur ſuſpects that when theſe caterpillars have conſumed all the flour, they eat the excrements which they had voided whilſt young. At leaſt it is certain that, upon opening ſeveral grains in which the inſect was young, a number of ſmall white pellets, like eggs, was found near the caterpillar; and a half-grown caterpillar being taken out of a grain, and laid upon a piece of glaſs at the focus of a miſcroſcope, it was ſeen to void a quantity of excrements, very white, ſmooth and oval; and when the caterpillars were ready to be metamorphoſed in the ſpring, there remained only a very ſmall portion of dark brown excrements, quite different from the white that were obſerved at firſt.

The length of the corn-caterpillar, when full grown, is very little more than the twelfth part of an inch; and it's thickneſs is, at moſt, equal to half the circumference of the grain that contains it: it's body is ſmooth and entirely white: it is thickeſt towards the head, in which one may perceive it's mouth, two large eyes, and two kinds of horns: the head is a little browner than the

the reſt of the body. This caterpillar has ſixteen legs, of which the eight intermediate and membranous are only ſmall prominencies, ſo minute as not to be diſtinguiſhed even with the help of a microſcope, unleſs the inſect be laid upon it's ſide.

My authors make here the following digreſſion, to ſhew the difference between this inſect (*Fig.* 23.) and the falſe moth (*Fig.* 31.); it being the more important to diſtinguiſh them, as they are very much alike in many reſpects, and often blended to gether in the ſame granaries.

The falſe moth proceeds from a ſmall caterpillar, the body of which is ſmooth and whiteiſh. It has ſixteen legs, does not lodge in the grains of corn, but contrives to faſten ſeveral of them together with a web which it ſpins, and with which it makes itſelf a dwelling place like that of common caterpillars. This dwelling place, or ſheath, in which the caterpillar of the falſe moth uſually abides, is generally in the middle of the little heap of grains which it has collected for it's food, as in *Fig.* 30: but, which diſtinguiſhes it from the caterpillar of the true moth, it can quit this ſheath at any time, to eat the grains around it, one after another. It generally attacks ſeveral grains at once, and always without order, eating ſometimes of one, and ſometimes of another, ſo that ſeveral are gnawn when not one is wholly conſumed. When theſe inſects are very numerous in a granary, all the grains upon the ſurface of the corn are linked together by a web, ſo as to form a cruſt which is ſometimes three inches thick. This caterpillar turns into a chryſalis, or aurelia, in a grain which it has hollowed, or in the ſheath of it's web, and iſſues from thence, in the month of June, in the form of a butterfly. When a heap of corn is ſtirred in which there are many caterpillars

pillars of the ſpecies of this falſe-moth, thoſe inſects crawl up the walls: but they ſoon return to the heap, and, by the very next day, cover it all over with a new web.

The inſect which deſolates many parts of Angoumois is more ſparing of the mealy ſubſtance of the corn, than the caterpillar of the falſe-moth; for the former ſeldom conſumes more than the contents of a ſingle grain. Nothing is more uncommon than for it to paſs from one grain to another, even though it be immediately contiguous. It eats the flour in ſuch manner that the ſkin or rind of the grain, which is entirely emptied, looks whole and ſound: but the leaſt preſſure then eaſily reduces it to powder; and it riſes up to the ſurface of water more or leſs quickly, according as the inſect has left in it more or leſs flour.

As heat haſtens the metamorphoſis of the inſect, it is not unuſual to find, in very hot weather, ſome of theſe caterpillars transformed into aureliæ, before they have conſumed the groſs excrements before mentioned, or even eaten all the mealy ſubſtance of the grain. In this caſe, the aureliæ are very ſmall, and produce only ſmall butterflies. The ſame happens to other inſects of this kind. Silk-worms eat but little when they are ſickly, and, if that ſickneſs continues, they are metamorphoſed ſooner than others which are healthy: but then their cocons always are ſmall. If a field-caterpillar be ſhut up in a box before it has attained it's full growth, it will, after having faſted ſome days, be converted into a ſmall aurelia, from which will iſſue a butterfly ſmaller than others of the ſame ſpecies. In like manner, when one ſees among the corn caterpillars ſome larger than others, it may reaſonably be preſumed that this difference proceeds from there having been a greater quantity of flour in the grains on which they

they fed, than in thoſe which were the nouriſhment of ſmaller flies; or from their having been of a ſtronger conſtitution. It likewiſe appears that ſome of theſe caterpillars are ſo much more voracious than others, that the flour of one grain is not ſufficient for them. M. Duhamel put ſeveral of them into a box of flour: they throve there, and ſeemed to grow larger than in their common way of feeding in the grain.

In general, they are metamorphoſed much ſooner in ſummer and when the air is warm, than in winter, or in cold weather. It may likewiſe be obſerved, that the mealy ſubſtance of a grain is more completely conſumed when the metamorphoſis is ſlow, then when the contrary happens.

The ſagacity of M. de Réaumur was requiſite to diſcover a ſingular circumſtance relative to the working of this inſect, and of which Meſſ. Duhamel and Tillet have been witneſſes. The caterpillar, exactly incloſed in it's grain, foreſees, or acts as if it knew, that, in it's future ſtate of butterfly, it will be deprived of the organs neceſſary to pierce through the rind of bran which forms it's priſon. However, whether it has or has not that foreſight, the fact is, that the caterpillar, before it is changed into an aurelia, makes in this covering of bran a ſmall trap *a* (*Fig.* 21.) which remains ſhut. Meſſieurs Duhamel and Tillet could not eaſily diſcover it at firſt; but after ſome ſearch, a little ſpot whiter than the reſt, about as big as the head of a ſmall pin, and ſomewhat prominent, ſhewed them where it was. They then, upon lifting up this trap (*Fig.* 22.) with the point of a fine needle, could ſee the chryſalis in the inſide of the grain, and could alſo, ſometimes, cloſe the trap again ſo exactly as not to leave the leaſt appearance of a hole.

When the caterpillar has attained it's full growth, and formed it's trap, or outlet, it weaves a cocon, and is afterwards metamorphoſed, within the grain, into an aurelia (*Fig.* 20.), which ſeems at firſt to be divided by ringlets (*Fig.* 14.): but when the butterfly is formed within the aurelia, it's wings may be diſcerned through the membranes which cover it, as in *Fig.* 15, 16, 17, 18. The abovementioned accurate obſervers opened ſome of theſe aurelia in an advanced ſtate, and took out of each of them a butterfly greatly rumpled and benumbed. When one of theſe caterpillars firſt iſſues out of an egg, and when a full-grown one is taken out of a grain of corn, the body of each, then ſeemingly more at eaſe, dilates, ſo that one can hardly conceive how it could be contained in ſo ſmall a ſpace as that from whence it came. The caſe is different when one opens a grain in which there is an aurelia; for it is eaſily ſeen that this occupies little more than half of the inner capacity of the grain which incloſes it, and that the caterpillar, in forming a cocon, has divided the grain into two ſpaces or cells, in the largeſt of which, being ſomewhat more than half, the aurelia is lodged, whilſt one ſees in the other nothing but it's excrements. The aureliæ are therefore ſmall in compariſon to the caterpillars that were metamorphoſed into them. Nor is it leſs ſurpriſing how a butterfly juſt come out of the aurelia could be contained within that covering.

The butterfly, being entirely formed in the aurelia, breaks the ſkin of it at the end, opens with it's head the little trap which the caterpillar had made on the outſide of the grain, and comes out at the little hole which was covered and ſhut by that trap. The mealy ſubſtance of the grain has, by that time, been ſo far conſumed, and the outſide

Fig. 1.

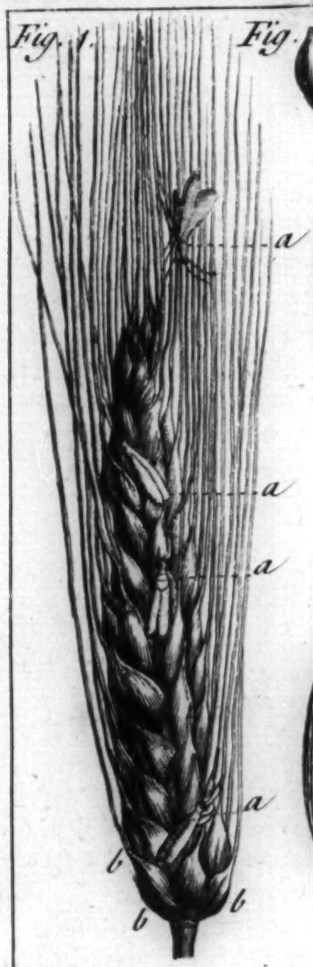


Fig. 2.



Fig. 3.



Fig. 4.



Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.



Fig. 9.

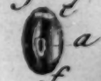


Fig. 10.



Fig. 11.



Fig. 12.



Fig. 13.



Fig. 14.



Fig. 15.



Fig. 16.



Fig. 17.



Fig. 18.



Fig. 19.



Fig. 20.



Fig. 21.



Fig. 22.



Fig. 23.



Fig. 24.



Fig. 25.



Fig. 26.



Fig. 27.

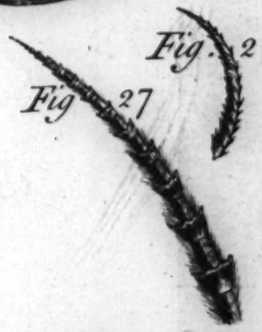


Fig. 28.

Fig. 29.



Fig. 30.



Fig. 31.



outſide huſk or bran rendered thereby ſo light, that the butterfly, after having diſintangled it's wings, takes it's flight, and ſometimes carries away the empty hull. As ſoon as the butterflies are out of the grains which contained them, they couple, and the females lay their eggs in the manner before related. Such is the circle of their life.

This inſect, like all others of the ſame ſpecies, remains, as was ſaid before, a longer or ſhorter time in it's different ſtates, according as the temperature of the air is more or leſs favourable to it's ſeveral changes. It is known that an aurelia of a caterpillar, which generally produces a butterfly in eight days, will continue three months in the ſtate of an aurelia, if it be put into an ice-houſe, and that the butterfly does not, in that caſe, come out, till after it has been removed into a much warmer air. For this reaſon one cannot fix preciſely the time within which the caterpillars are transformed into aureliæ, nor how long they remain in this ſtate: it can only be ſaid, that they come out of their eggs very ſoon when the air is warm, and that they ſometimes continue long in the ſtate of caterpillars, as well as in that of aureliæ, if the weather be cold: to which may be added, that both caterpillars and aureliæ, of different ſizes, are ſeen in the field in warm weather; that butterflies are ſeen to iſſue out of corn from harveſt till the end of September; and that caterpillars of various ſizes may be found in the infected grains during the whole winter.

"In the middle of May 1761," continue Meſſieurs Duhamel and Tillet in their account of this inſect, "when we arrived at la Rochefoucault, there were many caterpillars in the corn, very few aureliæ, and not many butterflies. The weather was then very dry, and the nights were cold. On the

the 21ſt, the wind changed to the weſt; and in a few days after, it began to rain, and continued ſo to do till the end of the month. During this time the thermometer was at from 13 to 14 degrees of Réaumur, or from 56 to 58 of Farenheit.

"In the beginning of June, we found in the grains of corn many more aureliæ than caterpillars; and on the 5th of that month, the air being then become pretty warm, we ſaw numbers of butterflies. By the 15th, they were increaſed ſo prodigiouſly in the cloſets where we made our experiments, that they perfectly darkened the day, and flew into our mouths if we opened them. We could then find but very few caterpillars, except in the corn which had been laid in cool places. We believe that the duration of the life of the butterflies is, in general, a fort'night or three weeks; though ſome of them have lived a month in our glaſs veſſels. The ſequel will ſhew that the whole circle of the life of this inſect may be completed in leſs than fifty days, when the air is warm.

"The coming out of the butterflies is generally denoted by a great heat in the heaps of corn, or in the ſheaves, according as the grain is laid up in one or other. It was ſuch as to make the liquor in M. de Réaumur's thermometer riſe to 25 and 30 degrees (from 62 to 71 of Farenheit) when the outer air was at 15, (35 and half of Farenheit). This heat certainly accelerates the hatching of the inſects; for prodigious multitudes of butterflies iſſue out of the heated corn in a few days after the ferment has taken place.

"The coolneſs of autumn interrupts their propagation; and no more butterflies appear from that time, till the warmth of ſpring begins to be felt. But, may not the heat which favours the multiplication of theſe inſects be produced by the creatures themſelves when aſſembled in vaſt numbers?

bers? This is very poſſible: for it is well known that there is a conſiderable warmth in well-ſtocked bee-hives; and that corn greatly infeſted with weevils or moths is alſo very hot. We ſhall hereafter have occaſion to obſerve that no ſenſible heat is perceived in heaps of grain in which there are but few caterpillars, and that the heat abates after moſt of the caterpillars have been changed into butterflies. It ſometimes happens that, through ſome cauſe or other, the heat goes off ſoon, and at other times it laſts three weeks or even a month. Perhaps too this great heat of corn full of caterpillars may proceed from the moiſture which thoſe inſects occaſion, and from thence may ariſe a fermentation capable of hatching the eggs, of making the caterpillars grow, of haſtening their tranſformations, and of bringing forth the butterflies, at the ſame time that it damages the corn, which thereby contracts a bad ſmell. It is certain, that when the harveſt is wet, and warm rains fall at that time, the corn heats very ſoon, and then theſe inſects make an extremely rapid progreſs. The heat which the corn contracts is doubtleſs very favourable to that progreſs, and the inſects certainly may then attack the grains ſoftened by the moiſture, more eaſily than they can thoſe which are hardened by drought. Accordingly, in 1760, a year in which the heat was great, and the air very dry, the corn in Anjou kept cool ſo long that many of the inhabitants of that province thought there would be but few inſects, and that the great heat of the ſun had killed moſt of the caterpillars. They flatter themſelves with the ſame hopes whenever theſe inſects do not appear in great numbers quite ſo ſoon as uſual, and imagine that few or none of them will come afterwards: but in that very year, which they thought ſo fatal to inſects, we ſaw butterflies come out of the ears of corn while they were in the reapers hands; we

ſaw

ſaw ſtill more fly about the ſheaves laid up in barns, and an inexpreſſible multitude upon the ſurface of corn depoſited in granaries, though neither of theſe grew very perceptibly hot till about the middle of September. In 1761, the corn was ſo much heated on the 8th of September, that though the outward air was of the ſame temperature as that in the vaults of the obſervatory at Paris, Réaumur's thermometer placed in one of thoſe heaps roſe to 53 (degrees, 131 of Farenheit's). The great heats of the ſummer had therefore only deferred the evil, and perhaps leſſened it a little. But this dreadful ſcourge returns every year. Theſe caterpillars, incloſed in their grain of corn, and ſheltered in barns or granaries, are ſcreened from the viciſſitudes and rigour of the air which deſtroy other inſects that are expoſed to them.

" Let us now review our inſect in all the ſeaſons of the year, in order to try to find under what circumſtances it may be attacked with moſt advantage.

" At harveſt-time, we ſaw butterflies come out of ſome grains, which were already empty and entirely conſumed, before they were reaped. Doubtleſs theſe firſt butterflies couple and lay their eggs upon the other un-reaped ears, and probably part of thoſe eggs are deſtroyed by the action of the flail, when the corn is threſhed and cleanſed ſoon after it's being cut: but as the caterpillars are hatched very ſpeedily in hot weather, and many of them can, as in fact we ſaw them, enter into the corn that is reaping, and ſhelter themſelves there; they will do all their miſchief, if ſpeedy care be not taken to ſtifle them, as we ſhall hereafter obſerve.

" The reaped corn is laid up in ſheaves, in barns, till the huſbandman can find time to threſh it, which is ſometimes ſooner and ſometimes later.

The

The corn thus piled up, heats; and the transformations of the inſects incloſed in it are then the the ſooner effected. When any of theſe piles of ſheaves were ſtirred in our preſence, we ſaw butterflies come out of them, and the grains from which they iſſued were empty of flour, and abſolutely ſpoiled. The moment theſe butterflies are out of their priſon, they couple, and lay their eggs upon the ears which they find in the barn. Part of theſe eggs, and of the young caterpillars, might certainly be deſtroyed by the flail and winnow, as we ſaid before, if they were uſed ſpeedily.

"Many peaſants in the country we are ſpeaking of make all the haſte they can to threſh their little crops, which they generally do upon a very dirty floor made in a hurry in the open air. They winnow and cleanſe their corn as ſoon as it has been threſhed; and the empty grains are then partly ſeparated from thoſe that are full, by the wind which carries the lighteſt away with the chaff.

"As the dirtineſs of the floor on which the ſheaves are threſhed fouls the grains of corn, theſe people waſh them, and thereby take off ſuch of the remaining light grains as ſwim upon the water. They likewiſe ſeparate the grains of which the caterpillars have eaten ſo much of the mealy ſubſtance as to render them ſpecifically lighter than the water: but the grains of which the caterpillars have not eaten much of the flour, ſink to the bottom with the ſound ones; and the caterpillars devour thoſe infected grains after they are ſoftened by the water, much ſooner than thoſe which are thoroughly dry.

"Moſt of theſe peaſants, knowing the ill-fate that will attend their corn, ſell it as ſoon as poſſible to dealers, who carry it into the neighbouring

ing provinces, and with it the contagion. This is the real cauſe which ſpreads the evil. Others have their corn ground immediately after harveſt; and this is the beſt method they can take, though not without it's inconveniences: for, in the firſt place, there are not mills enough in the country to grind immediately the whole produce of the crop; ſecondly, the meal of corn gathered in a wet harveſt will not keep long; and laſtly, though the friction of the mill-ſtones undoubtedly deſtroys almoſt all the inſects, it is not certain but that ſome of them may eſcape; and in that caſe they will thrive, and go through their ſeveral metamorphoſes, firſt into aureliæ and afterwards into butterflies, in the flour, as we have experienced in the manner before related.

"Several of the inhabitants of the country in queſtion lay their corn up in granaries, in order therewith to pay their rent, which, in general, is not due till the beginning of October. From theſe heaps of reſerved corn iſſue multitudes of butterflies, which, as we have obſerved, couple and lay upon that corn an immenſe quantity of eggs, from whence proceed caterpillars which get into the grains, and devour their inſide during the whole winter.

"It is highly probable that, in mild and moiſt autumns, ſome of the firſt-hatched caterpillars may be changed into butterflies early enough to produce a ſecond generation before winter; nor will this ſeem ſurpriſing to thoſe who know how rapidly warm weather makes theſe inſects go through all their metamorphoſes. But, independant of this, it is certain that butterflies are continually ſeen to come out of all the heaps of wheat, barley, and rye, in Anjou, during the whole ſummer, and till the autumn begins to grow cold; that numbers of live caterpillars are found in the grains during

during the winter; that many aureliæ are found in them towards the end of May; and that prodigious multitudes of butterflies iſſue from them as ſoon as the wheather begins to be hot, that is to ſay, towards the middle of June.

"Thus we ſee that there are, in a manner, two flights of butterflies; one which appears from harveſt-time till the weather grows cold in September, and the other which appears in June and laſts till harveſt. The former, in our opinion, proceed partly from granaries in which corn of the preceeding year has been laid up with young caterpillars in it, and partly from the eggs firſt laid upon the ears, towards the end of May, or upon the new reaped corn; ſo that the ſecond flight begins juſt as the firſt flight ends.

"A circumſtance well worth obſerving, and which will be more particularly noticed hereafter, is, that moſt of the butterflies of the ſummer flight remain in the granaries, faſt clung to the threſhed corn, upon which we have ſeen them couple and lay their eggs. It looks as if theſe butterflies knew that there then no longer is in the fields any corn fit to feed their poſterity. On the contrary, thoſe of the ſpring-flight endeavour to get out of the granaries, and do in fact get out in vaſt numbers, through the windows, to ſpread in the fields, and lay their eggs upon the yet green corn."

That this is really the caſe, and that theſe inſects are of the ſpecies called *phalenæ*, appeared evidently from ſeveral very accurate obſervations, made by Meſſeiurs Duhamel and Tillet, and of which it may be ſufficient to mention here only the following.

In June 1761, they went, at different hours of the day, into granaries where there were heaps of corn infected with theſe inſects. While the day

day laſted, they perceived a multitude of butterflies which ſtirred a little upon thoſe heaps, but did not quit them. When they returned into the ſame granaries a little after ſun ſet, they ſaw thoſe butterflies riſe from the corn, and fly to the walls, where they ſettled for a while; after which they took their flight in vaſt numbers, through the windows, and went off with ſuch rapidity that they ſoon got out of ſight. If Meſſieurs Duhamel and Tillet went back into theſe granaries at ten or eleven o'clock at night, they no longer ſaw ſo great a number of butterflies, and thoſe that did remain ſeemed to be leſs agitated.

To be ſtill more perfectly acquainted with ſome circumſtances of the life of this inſect, they put different ſorts of corn into ſmall cloſets, in September 1760, after having paſted white paper all over the walls and ceiling. In the beginning of June 1761, theſe cloſets ſwarmed with butterflies, which ſeemed to be pretty quiet during the day, and were ſeen to be greatly agitated towards the ſetting of the ſun: but they could not get out of the cloſets, becauſe the windows were cloſely ſhut. On the 9th of June, towards eight o'clock in the evening, one of the cloſet doors being opened, a prodigious number of butterflies immediately iſſued out, and, with ſurpriſing ſwiftneſs, traverſed an oppoſite granary, without making the leaſt ſtop, though ſeveral heaps of wheat lay in it. They bent their courſe directly to an open window of the granary, at ſome diſtance from the cloſets, and inſtantly haſtened out. Several people, who were preſent, followed them with their eyes, till the ridge of a barn near forty feet off, and the decline of the day, prevented their ſeeing them any further. Our obſervers returned to the ſame cloſet at about ten o'clock at night, and then found the remaining

ing butterflies very quiet, ſcarce one of them attempting to fly out.

Theſe obſervations prove ſufficiently that this ſpecies of butterflies is noctural, and that thoſe of the June flight have a different inſtinct from thoſe which do not appear till after harveſt. Theſe laſt remain upon the corn in the granary, and there couple and lay their eggs, from whence proceed caterpillars which penetrate into the grains as ſoon as they are hatched. The June caterpillars, on the contrary, act as if they knew that the bloſſoming of the corn is paſt, and that it's ears are fitted to ſupply their poſterity with the neceſſary food. They ſeldom leave the granary before ſun-ſet, unleſs dark clouds chance to beguile them earlier, in which caſe numbers of them become the prey of ſwallows and martins, which fly about the windows.

As theſe little inſects fly very ſwiftly, and riſe to ſuch a height that the eye cannot follow them long, eſpecially when the duſk of evening begins to come on, Meſſieurs Duhamel and Tillet were obliged to try ſeveral methods before they could be certain what became of them. The caterpillars which they found in the grains of ſtanding corn made them conclude that the butterflies, when out of the granary, flew directly to the green corn, and laid their eggs upon it's yet tender ears: but none of the country people, of whom they inquired, had ever obſerved them in the fields, or could give any ſatisfactory account of them. Another well atteſted circumſtance, which ſtrengthened their conjecture, was their being aſſured by perſons of undoubted credit, that the corn which grows neareſt to villages, farm-houſes, barns, or buildings uſed for granaries, is always much more damaged by inſects than that which grows at a diſtance from any habitation. Their own obſervations con-

firmed this fact; and their experiments, dictated by reaſon, ſoon proved that they had conjectured right.

Deſirous to know what was become of the ſwarms of butterflies which they had ſeen go out of the granaries in June 1761, they ſearched all the neighbouring fields of every kind of corn, and beat even the ſurrounding hedges, at all hours of the day, to no ſort of purpoſe: not a butterfly could they find, excepting a few dead and dried ones intangled in ſpiders webs along the outſide of the corn. This very circumſtance led them to the diſcovery they were in queſt of: for, rightly reflecting that theſe inſects, which neither they nor any other perſons had been able to find in the fields in the day time, muſt certainly be of the *phalenæ* or nocturnal kind; they, without farther delay, ſet out with a candle and lanthorn, repaired to one of the corn fields which they had viſited in the afternoon, and, in the night between the 5th and 6th of June, ſoon deſcried a great number of the very butterflies they were ſeeking for, upon the beards of the ears of wheat. They returned to the ſame ſpot early the next morning, and could not then find a ſingle one.

From that time they ſaw and ſhewed to whoever choſe to ſee them, a great number of theſe butterflies upon the ſtanding wheat and barley. Some were upon the beards, and others had made their way to the point of the grain. Scarce an evening paſſed without their ſeeing ſome of them coupled: Though every circumſtance concurred to prove, and indeed left no room to doubt, that theſe butterflies were the ſame as thoſe which infeſted the corn in granaries; yet, to be thoroughly convinced, and to convince others, in this reſpect, they took ſome of them from off the ears of corn in the field, examined them with a microſcope, and found

found them to be of the very ſame ſpecies. A farther demonſtration of this reſulted from the following incidents. M. de Taponnat, one of their friends in Angoumois, had, in a ſmall granary, ſeveral heaps of wheat differently prepared, which he kept by way of experiment. Meſſieurs Duhamel and Tillet obſerving numbers of caterpillars in two of thoſe heaps, adviſed him to put that corn into an oven properly heated, in order to prevent the diſperſion of the butterflies, which they knew would otherwiſe infallibly proceed from thence: but this was neglected. On the 21ſt of June, about ſeven o'clock in the evening, they viſited this little granary, and found upon the corn a multitude of butterflies in great agitation, and of which a conſiderable number ſoon flew out at the windows. They took leave of M. de Taponnat, aſſuring him that this flight of inſects would ſoon light upon his ſtanding corn. When they were gone, M. de Taponnat had the curioſity to ſtep out, to ſee whether any great quantity of butterflies ſtill continued to iſſue from his granary; which he could eaſily do, as the window was very low. He was amazed at the numbers he ſaw fly out at that one window; being, as nearly as he could compute, about fifty in a minute. He obſerved, that they directed their flight towards a field of wheat not far off, and thereupon went thither with five or ſix other perſons, all of whom ſaw them arrive in ſwarms, proceeding chiefly from the granary. They ſaw many of them light upon the ears, and on their running a cane gently over the awns, beheld them riſe by dozens at a time. M. de Taponnat was ſo ſtruck with this ſight, that he ordered the window of his granary to be ſhut the next day, and his corn to be put into an oven properly heated, as ſoon as poſſible.

A clergyman in the neighbourhood, who had a little barley infeſted with theſe inſects, could not be perſuaded to do the ſame, though his whole quantity was but a few buſhels. The conſequence was, that a multitude of butterflies were ſoon ſeen to proceed from the window of his granary, and ſpread ſo thick over an adjacent field of barley, that not an ear could be found without ſeveral of them upon it.

Theſe facts confirm all the former remarks of our accurate inquirers, who, after obſerving that the fitteſt time to find theſe butterflies upon the ears of ſtanding corn, is about half an hour after ſunſet, continue thus.

"On the 10th of June, about eight o'clock in the evening, we viſited the fields around la Rochefoucault, and then perceived only a few butterflies upon the ears of the corn: they were greatly agitated; and we ſoon after ſaw numbers of the ſame ſpeices arrive on all ſides, but chiefly from certain mills on the banks of the river. Thoſe that were upon the corn flew away as ſoon as we approached them with a light. This was probably the time of their arrival. Towards nine o'clock we renewed our ſearch, and ſaw many of them clung to the ears, either actually coupled, or ſeeking to couple. The light did not affright them, then, and we had time enough to examine them with a microſcope. We found fewer of them towards midnight, and could not ſee any early the next morning. It is not to be ſuppoſed that the diſperſion of theſe butterflies happens always regularly at the hours before mentioned; for we have obſerved ſeveral variations, which depend on the warmth of the air; and they commonly ſettle upon the corn earlier when the ſun is over caſt with clouds juſt before it's ſetting.

"As we have not ever met with theſe butterflies in the day-time, it may be aſked, where they then

then retire to? This queſtion deſerves an anſwer. We have ſearched for them in vain in hedges and among the blades of corn. Light certainly incommodes them: for when we expoſed to the ſun veſſels in which ſome of them were incloſed, they hid themſelves in the ſhade formed by creaſes of the paper at the bottom of thoſe veſſels, in ſuch manner that we were ſometimes puzzled to find them again. One day that the ſun ſhone very bright, we took two cryſtal cups, into one of which we put a few grains of wheat with ſome butterflies, then covered it with paper, and placed it upon it's bottom, in a garden expoſed to the ſun. We put ſome butterflies into the other, but not any corn, and placed it cloſe to the former, with it's bottom upmoſt, that the butterflies might receive the full heat of the ſun: and laſtly we ſet one of M. de Réaumur's thermometers upon the ground, juſt by theſe cups. When the liquor had riſen to from 45 to 50 degrees, (from 112 to 124 of Farenheit's), we ſaw that all the butterflies in the cup where there was not any corn, were dead: in the other, only ſome were dead; becauſe moſt of them had found a ſhady ſhelter, either by making their way into the grains, or by hiding themſelves under the paper cover. We knew before, that theſe butterflies are greatly agitated and flutter very much when they are expoſed to the ſun; but we could not tell whether that proceeded from pleaſure or pain. The doubt is now removed; and we are of opinion that they retire to a cool or ſhady place during the day time, and that their ſmallneſs prevents our finding where they are hidden, which may perhaps be in woods or thickets, in crevices in the bark of trees, or in the earth."

That the caterpillars which produce firſt aureliæ and then theſe butterflies can, and frequently do live under ground, that they can paſs the winter there incloſed in the grain with which they are

ſown, and even undergo their ſeveral metamorphoſes in the earth, ſo as to ariſe from thence in the form of butterflies in the ſpring, has been demonſtrated by the following experiments.

In May 1761, Meſſieurs Duhamel and Tillet planted, in a garden-pot, corn in which they knew there were caterpillars. They buried it an inch deep, watched it carefully, and ſaw that, notwithſtanding plentiful rains had fallen upon it, thoſe caterpillars changed into aureliæ juſt as if they had been in a granary. Theſe aureliæ produced butterflies, which, weak as they were when firſt hatched, ſoon made their way out of the ground.

To be the more certain of their power with reſpect to this laſt article, the ſame gentlemen put ſome thoroughly dry, and well pulveriſed earth into a glaſs veſſel, then laid upon that earth a layer of corn in which they knew there were aureliæ, and covered this with equally well dried and pulverized earth, at leaſt half an inch deep; after which they tied a paper over the veſſel, to keep in the butterflies, in caſe they ſhould pierce through the upper mould. In effect, they did pierce through it, coupled, and laid ſuch quantities of eggs as covered it's whole ſurface.

To ſee whether theſe inſects would riſe as eaſily from underneath a ſtiffer earth, and what effect their being buried deeper would have, a wooden box was divided into three partitions, and filled with common mould taken out of a kitchen garden. Corn known to be infeſted with theſe caterpillars was planted an inch deep in one of theſe partitions, two inches deep in another, and three inches in the third. All of them were then covered with a glaſs frame, and butterflies ſoon appeared in each of the diviſions; but they were far moſt numerous in that where they had been buried but an inch deep. In another trial, a number of

infeſted

infected grains was covered with a ſtill ſtiffer earth, wetted, and preſſed down; and not any butterflies appeared there. At their firſt coming out of the ground they are rumpled, as when taken out of a chryſalis: but after reſting a moment, they ſhake their wings, ſet them right, and ſoon take their flight.

That ſome of theſe butterflies can, and do come out of the plowed ground which has been ſown with infected ſeeds, is certain: but Meſſ. Duhamel and Tillet are thoroughly ſatisfied that their number is but ſmall, that moſt of the caterpillars ſown with the grain periſh before they can reach the ſurface of the earth, and that the butterflies which proceed from granaries are the great ſource of the increaſe of this inſect: for, ſay they, the grain which contains a young caterpillar will grow, if it's germe has not been damaged; and as it's mealy ſubſtance is conſumed by the plant, the caterpillar muſt die for want of food. Beſides, as is proved by the laſt mentioned experiment, the butterflies cannot pierce through a cloſe and hardened earth; which generally is the caſe of plowed land that has been expoſed to the winter rains.

After obſerving that the two ſexes ſometimes unite a ſecond time after ſeparation; that the female depoſits her eggs almoſt immediately after they are fecundated, in ſmall parcels of from ſix to 30, and that each female lays in all from 60 to 90; adding to this that there are generally three flights in a year, one at the latter end of May or in the beginning of June, a ſecond in Auguſt, and a third in ſome of the ſubſequent months, during which a fourth alſo, and even a fifth, have been known; we may, from the following calculation, form an idea of the aſtoniſhing multiplication of theſe inſects, and conſequently of the ravages which

they muſt make where they have eſtabliſhed themſelves.

Every female produces from 60 to 90 eggs, of which 75 is the medium: but let us ſuppoſe the number to be no more than 70. Let us ſuppoſe alſo, that of thoſe 70 eggs, one half only produces females, which makes the number 35. This multiplied by 70, the number of eggs laid by each, gives for the ſecond brood, from a ſingle inſect, 2450: the half of this number, ſuppoſed to be females, is 1225, which multiplied by 70, gives 85,750 for the third brood. The half of this number, being 42,875, multiplied by 70, gives for the fourth brood, 3,001,250; and the half of this, 1,500,625, multiplied by 70, gives 105,043,750 for the fifth brood: ſo that ſuppoſing five broods in a year, each female butterfly of this ſpecies that exiſts in May, produces, before the May following, no leſs than one hundred and five millions, forty three thouſand, ſeven hundred and fifty individuals of the ſame kind.

It is not agreed whether theſe inſects prefer wheat, barley, or rye. The obſervations and trials made by Meſſ. Duhamel and Tillet ſeem to prove, that they attack indifferently whichever lies moſt convenient for them; and that they do not ſpare maize, when it is ſtripped of it's ſtalk and laid up in a granary where they can come at the ſoft inſide part of the grain; or even oats, though it be the common, but miſtaken opinion of the people of Angoumois, that this laſt grain is a preſervative of others, eſpecially of barley, when ſown with it, or intermixed in the ſame heap.

M. Tillet incloſed ſeveral ears of ſtanding oats in a wide-mouthed glaſs bottle, and put into it ſome of theſe butterflies; after which he covered the mouth with a piece of fine linen. The butterflies

flies coupled there, laid their eggs upon the ears, and ſeveral caterpillars which proceeded from thoſe eggs actually introduced themſelves into the grains. A manifeſt proof that, though the pendent poſition of the grains of oats, whilſt growing, may be inconvenient to the female butterflies, many of whoſe eggs may be waſhed or blown off, more eaſily than from other corn, before they are fixed by the viſcous matter which faſtens them to the huſks; yet the corn-caterpillar can live upon oats. What is ſtill more extraordinary, is, that grains of wheat, barley, rye, and oats, were mixed together in a glaſs veſſel, into which ſome of theſe butterflies were put: and the oats were damaged by caterpillars, as much as any of the other grain: though it is certain that theſe inſects do but little miſchief to oats in the granary; happily for the poor people who make bread of this corn.

In guarding againſt theſe inſects, the farmer has three objects: 1, to preſerve his grain for ſeed; 2, to keep it for food and market; and 3, the total deſtruction of the inſects.

To preſerve the corn for ſeed, it ſhould be threſhed out as ſoon as poſſible, in order to prevent the transformation of the caterpillars brought from the field, which otherwiſe ſoon become butterflies, whoſe prodigious number of eggs would exceedingly increaſe the evil. For want of this precaution, two thirds of the ſtore of ſeed-corn has frequently been deſtroyed.

The moſt effectual means has been found to be drying of the corn in an oven; in which operation it is neceſſary to obſerve, 1, that the oven be hot enough to kill the caterpillars, and 2dly, that the heat be not ſo great as to deſtroy the germe, or vegetative power of the grain. Though M. Duhamel has ſeen corn grow after it had endured a heat of 60 degrees of Réaumur's ther-

thermometer; which are equal to 142 of Farenheit's; yet there is danger in making it undergo that heat, eſpecially if the quantity put into the oven be but ſmall. They who have hit on the proper degree of heat, have ſeen their corn riſe well, and yield a plentiful crop. Others have complained of it's coming up very thin, though they had ſowed the ſeed thick. The corn of theſe laſt muſt either have undergone too much heat, or a great deal of it has been eaten by the caterpillars before it was put into the oven. If they had waſhed it in lime-water, and ſkimmed off all the light grains, their ſeed-corn would certainly have been better.

It appears from an experiment made by M. de Taponnat, that theſe caterpillars are killed by a heat of 50 degrees of Réaumur's thermometer (equal to 124 of Farenheit's), provided the corn be ſpread thin in the oven, that it remain there three days, and that the quantity be not more than 150 pound weight. But if 600 pounds were put into the ſame oven, it muſt be heated to 60 degrees of Réaumur's thermometer (142 of Farenheit's), and be ſtirred from time to time; and if the quantity be 900 pounds, the heat muſt be increaſed to 70 degrees of Réaumur's (160 of Farenheit's) thermometer, and the corn muſt remain in it four days, ſtirring it often. The reaſon of this difference is, that a greater quantity of corn checks the heat proportionally, and requires a longer time to be equally heated.

As it is not eaſy for farmers who have not thermometers to gueſs at the preciſe degree of heat, they may take the following method, which will likewiſe preſerve their grain from ſmut, &c. Let the corn be threſhed and winnowed the day it is reaped. This will deſtroy numbers of caterpillars that have not yet pierced into the corn, and

and with them many of the eggs lodged upon the chaff, which would otherwiſe produce caterpillars in a few days. As ſoon as a ſufficient quantity of corn is thus collected, a ſtrong lye ſhould be made with wood-aſhes; and when this lye is become yellow like beer, and ſlippery to the touch, as much quick lime ſhould be added as will make it of a duſky white. When it's heat is ſuch that the finger can but juſt bear it, let the groſs part of the lime ſubſide, then pour off the lye into a proper veſſel, and, having the grain in a baſket, plunge the baſket with the grain into the lye, ſtirring it about, and ſkimming off what floats on the top. This will chiefly be the grains which are become light by the caterpillars having conſumed their flour. When the corn has been thus ſoaked for about two minutes, the basket which contains it ſhould be lifted up, and ſuſpended by two poles, till the lye is drained off. The grain ſhould then be ſpread very thin on the floor of a granary, to dry, while a ſecond basket-full is prepared in the ſame manner. The corn thus ſteeped and well dried will keep a year, and continue fit for ſowing. Wheat thus prepared in in Auguſt 1760 was ſowed in July 1761, and roſe very well.

That this lye certainly kills many of the caterpillars, appeared from an experiment made with 20 grains of wheat into which thoſe inſects had pierced. They were tied up in a thin rag, ſteeped in it, and 17 or 18 of the caterpillars were deſtroyed. It hardens the grain, which is ſo incruſted by the lime, that the caterpillars cannot eaſily penetrate into it; though the butterflies which proceed from infected corn, or from the few caterpillars which may have eſcaped the lye, may lay their eggs upon it, if it be left expoſed, and thereby endanger it. This may be prevented by gathering

thering the corn into a heap in the middle of the floor, as ſoon as it is thoroughly dry, and covering it with an oil-cloth, or tarpaulin, or, which may be yet more eaſily done, with aſhes or powdered lime, to the thickneſs of an inch. Theſe will give a paſſage to the few butterflies which proceed from the heap, without a poſſibility of their depoſiting their eggs upon the corn. By this means the farmer will be ſure to have ſound corn for ſeed; excepting the few grains out of which the butterflies may have made their eſcape.

The corn which is intended to be kept for food or ſale ſhould likewiſe be cut down with all poſſible ſpeed. Every moment then is of great importance, to prevent the rapid increaſe of theſe miſchievous inſects. He who can deſtroy them before thoſe which are carried from the field have laid their eggs, will not looſe a fortieth part of his corn; whilſt his negligent or ſlothful neighbour, who defers the remedy till the middle of September, will loſe half his crop; and if he puts it off, for a month longer, he will not have a ſixth part left. The beſt way therefore is, to threſh the corn as faſt as it is cut; by ſetting reapers and threſhers to work at the ſame time. The wheat ſhould be threſhed firſt, then the barley, and afterwards the rye. Oats, peas, &c. may be left to a more leiſure time. As faſt as the corn is threſhed, it ſhould be winnowed, to ſeparate the light grains, in moſt of which there will be inſects. It muſt then be dried in ovens, or rather in ſuch ſtoves as will be deſcribed in the following chapter, for the preſervation of corn in large granaries. It is of conſequence that this be done before the inſects are grown big; for they occaſion but a trifling loſs while they are ſmall. The corn ſhould be winnowed again when it is taken out of the oven, to ſeparate the remaining light grains; after which it

will

will require no farther trouble than barely to ſecure it from the butterflies which might lay their eggs upon it. This purpoſe will be anſwered by covering it as before directed; only obſerving, that if it is covered with aſhes, and intended for food, it muſt be waſhed before it is ſent to the mill It may remain uncovered from the time of the diſappearing of the butterflies in the winter, till the middle of May; after which it will be neceſſary to cover it again: or, which is better than covering it in a heap, it may be put into ſtrong ſacks placed upon treſtles, the feet of which ſhould be covered with tin, to prevent mice and rats from climbing up.

When corn is dried in an oven, thoſe parts of it which are next to the bottom and ſides are ſometimes parched, or even burnt, while the centre of the heap is not heated enough to kill the caterpillars. A large quantity put in together cools the oven too much, and it is long before the heat penetrates the heap. To avoid theſe inconveniences, the mouth of the oven deſtined for this purpoſe ſhould be wide enough to admit a hurdle covered with a coarſe canvas, on which a proper depth of corn ſhould be ſpread. The hurdle ſhould then be ſhoved into the oven, the door of which ſhould afterwards be ſhut, and the corn upon the hurdle muſt be turned from time to time. It is proper here to attend to the following obſervations.

1. Grain expoſed during many days to a heat which cauſes Réaumur's thermometer to riſe to 60 degrees (142 of Farenheit's), loſes no degree of it's fertility.

2. This heat continued eleven hours will totally deſtroy all the inſects contained in the grain, whether they be caterpillars, aureliæ, or butterflies; and heat equal to only 33 degrees of Réaumur's

mur's (94 of Farenheit's) thermometer, will anſwer the ſame purpoſe if it be continued two days.

3. 2500 pounds of grain being put into an oven in which the heat was 85 degrees of Réaumur's (278 of Farenheit's) thermometer; the heat in the centre of the heap was, an hour afterwards, found to be no more than 19 of the former, or 66½ of the latter. It gradually increaſed for 48 hours, and at the end of that time it was found to be 33 degrees and an half of Réaumur's (93 of Farenheit's) thermometer, which then was the general heat of the oven.

4. The uſual heat of an oven, two hours after the bread has been drawn, is about 100 degrees of Réaumur's, or 246 of Farenheit's thermometer.

5. Grain which has endured 90 degrees of heat according to Réaumur's thermometer, which would be 294½ of Farenheit's, is not the leſs fit for making bread.

M. de Taponnat, put 200 pounds of wheat, upon a hurdle, into an oven which had been heated with three faggots of bruſh-wood. M. de Réaumur's thermometer roſe to 68 degrees (equal to 154 of Farenheit's) when laid upon this corn, which, after having endured a heat of 70 degrees (160 of Farenheit's) during upwards of two hours, and being afterwards left in the oven during almoſt three days, was perfectly dry, al the inſects in it were killed. Sixty grains of this corn were ſown, and fifty of them ſprouted.

The ſame oven was heated again with three other faggots, and 300 pounds of rye were laid upon the hurdle, without ſweeping or cooling the floor of the oven. M. de Réaumur's thermometer roſe to 75 degrees (172 of Farenheit's): the oven was then opened, to leſſen the heat, and the corn was drawn out at the end of 46 hours. There were

were then in in it ſome caterpillars not entirely dried up. Out of 60 of theſe grains which were ſown, 51 grew.

The oven was afterwards heated with two faggots; 300 pounds of rye were put into it upon a hurdle; Réaumur's thermometer roſe to 70 degrees (160 of Farenheit's); the corn remained in this oven cloſed during 82 hours; all the inſects in it were thereby ſtifled and dried up; and 60 of theſe grains being planted in the earth, 54 of them ſprouted.

This is undoubtedly the beſt method of drying corn in an oven; becauſe it is thereby preſerved ſound, no part of it is burnt, it is heated equally by being ſtirred from time to time upon the hurdle, and it will endure a heat of 75 degrees of Réaumur's (172 of Farenheit's) thermometer, as we have ſeen, without loſing it's vegetative power: therefore, when corn is to be kept for ſeed, particularly, a hurdle ſhould be uſed. The only objection that can be made to it is, that ſo great a quantity cannot be dried at a time in this way, as when the grain is ſpread all over the oven. But that inconvenience may be remedied by making the oven deeper in proportion than is uſually done. Let it be, for example, 20 or 25 feet deep, and eight feet wide; though the common breadth for that depth would be about 14 feet; and let the mouth be ſhaped in ſuch manner as to admit a hurdle ſix feet wide: now, a hurdle of which the ſurface is 120 feet, will contain 3600 pounds of wheat laid ſix inches deep. That the hurdle thus heavily laden may not be too difficult to move, at leaſt ſo far as to bring it ſufficiently forward at the mouth of the oven, where it may be convenient to draw it out to a quarter or a third part of it's length, in order to lay on, or take off, the corn with a ſhovel; it may be made to run upon eight

or

or ten ſmall wheels; or the grain need not be laid on ſo thick as ſix inches. Perhaps it may be neceſſary in an oven of this depth, and not wider than the above dimenſions, to make a vent hole ſix or eight inches wide, in the back or hindmoſt part, in order to let out the ſmoak: this hole may be ſhut after the floor of the oven is ſufficiently heated, and the fire may then be drawn forward, that the ſmoke and flame iſſuing out at the mouth, may alſo heat it there.

The corn thus dried in an oven looks ſomewhat ſhrivelled when it is firſt taken out; but at the end of three or four months, it becomes as plump as ever: nor is it at all damaged for making bread, if it be properly managed. Some, indeed, have complained, that their meal has had a bad ſmell and taſte, and they have been right in ſo ſaying: but the fact then has been, that a great part, perhaps half, or even more than half, of their corn was ground with the dried caterpillars in it; a circumſtance which muſt neceſſarily hurt it's quality.

To obviate this defect, the corn ſhould be dried in a ſtove or oven, as was ſaid before, as ſoon as poſſible after harveſt; it ſhould be well winnowed before it is put into the oven, in order to take out of it as many inſects as poſſible; it ſhould be winnowed again when it is taken out of the oven, becauſe all the grains in which the inſect is dried up will then be very light; and laſtly, it ſhould be waſhed, and all the grains that ſwim upon the water ſhould be skimmed off, before it is ſent to the mill. The moiſture then imbibed by the grains will render them plump, like new corn; and the bran which has been exceedingly dried by the heat of the oven, will by this means be rendered ſupple and fit to grind. The flour of this, like the flour of very old corn, requires ſomewhat

more yeaſt or leaven, to make it riſe, than would do for corn that has not been dried.

As many country people are not provided with thermometers whereby to regulate the exact degree of the heat of their ovens, it is proper to obſerve, that the preciſion before mentioned is not neceſſary when the corn dried in them is not intended for ſeed; experience having ſhewn, that it is not the worſe for making bread after it has undergone a heat of from 72 to 100 degrees of Réaumur's (166 to 250 of Farenheit's) thermometer: and with regard to ſeed-corn, a method of keeping it, without drying it in an oven, has been already pointed out. However, if any ſhould think it moſt adviſeable to dry that corn alſo, they can but try the planting of ſome grains before they ſow the reſt; and if the germe has been deſtroyed by two much heat, that parcel may be kept for bread, whilſt another quantity is more carefully prepared for ſowing.

For want of a thermometer, a piece of coarſe yellow bees-wax, about the bigneſs of a walnut, may be laid upon a tile or a piece of earthen-ware placed upon the bottom of an inverted empty buſhel, or other ſimilar thing, put into the oven, ſo as to prevent it's receiving the immediate heat of the floor. If this wax is entirely melted within a quarter of an hour, the heat of the oven may be ſuppoſed to exceed 80 degrees of Réaumur's (190 of Farenheit's) thermometer; and if, on the contrary, only half of it is melted at the end of half an hour, the heat may be reckoned at between 70 and 80 degrees of the former, or 160 and 190 of the latter. Upon the whole, practice will ſupply the want of an exact regulator, as is daily ſeen in the baking of bread, for which every ſervant-wench in the country knows how to heat the oven to a proper de-

gree. General directions for the quantity of fuel would be of little uſe; becauſe the heating of an oven depends upon the manner in which it is heated, upon it's form, and upon it's ſize. A general rule, highly proper to be obſerved on this occaſion, is, that it is better to let the corn remain long in the oven, than to make it undergo a too intenſe heat.

In order to be certain whether corn intended for ſeed can be dried in the above manner, without hurting it; M. de Cers put 1200 pounds of wheat into one of his ovens, and 800 pounds into another[a]. The former was big enough to contain as much bread as is made with 200 pounds of flour, and the latter only 150. Réaumur's thermometer marked 72 degrees (164½ of Farenheit's) in the largeſt of theſe ovens, and 83 (197 of Farenheit) in the other, when the corn was put in. It remained there 48 hours; at the end of which the thermometer in the large oven marked 25 degrees of Réaumur's (62 of Farenheit's) thermometer, and that in the leſſer 26 degrees of the former, which are equal to 64 of the latter. M. de Cers ſowed 50 grains of each of theſe parcels, and all of them ſprouted except one. He obſerves on this occaſion, that as ſo great a degree of heat is not neceſſary in order to deſtroy the caterpillars, one may be aſſured that corn put into an oven an hour after the bread has been drawn, or into an oven which has been heated with three faggots, will yet be in a condition to grow. He allows, that the vegetative quality of the corn will probably be deſtroyed when only a ſmall quantity of it is dried in too great a heat; for a large quantity, checks and moderates the heat of the

[a] *Hiſt. d'un Inſecte de l'Angoumois, par Meſſ.* DUHAMEL & TILLET, *p.* 277.

oven;

oven: and he believes that the injury done to the germe by too much heat, may frequently be remedied by ſteeping the grain in water.

This is confirmed by M. Duhamel, who, to try the experiment, dried a parcel of corn in a ſtove heated to ſuch a degree as he thought muſt certainly deſtroy the germe of every grain. He afterwards ſowed this corn, and, at the end of three weeks, when he had quite given it up, almoſt all of it ſprouted. Some grains roſe ſooner than others; and he thinks it highly probable that all of them would have ſprouted ſooner than they did, if he had ſteeped them in water before they were ſowed.

This experiment proves that corn can bear a great degree of heat without loſing it's fertility; and the fact is ſtill farther confirmed by the following incident.

One of M. de Cers's farmers put a parcel of bearded wheat into an oven, as ſoon as the bread was drawn; and as his deſign was only to preſerve it from inſects, he did not care how much it was heated. A neighbouring huſbandman, who was in want of ſeed-corn, deſired to purchaſe ſome of this; and, though told that it had been greatly dried in an oven, he bought it; ſowed it, and found it grow as well as any that had not been dried.

To know to what degree an oven ſhould be heated, in order to kill the butterflies in the middle of a large heap of corn, M. de Cers had recourſe to the following expedient.

The oven being heated and well ſwept, he put into it 1250 pounds of wheat, laid the ſurface of this corn ſmooth with a rake, placed upon it a tube of tin five feet long and three inches in diameter, and then put in 1250 pounds more of grain. The heat of the oven was then 85 degrees

of Réaumur's (220 of Farenheit's) thermometer. After this, he introduced into the tube one of Réaumur's thermometers, and a glaſs cup in which there were about an hundred grains of wheat and ten butterflies. This cup was covered with a paper pierced through with many pin-holes, and both it and the thermometer were faſtened, each of them, to the end of a ſtick, to draw them out for inſpection. The oven was ſhut at nine o'clock in the morning; at ten, the thermometer marked 18 degrees (65 of Farenheit's); at eleven, 18½ (66 of Farenheit's;) at noon 19½ (68 of Farenheit); at one o'clock, it was at 20 degrees (69 of Farenheit); at ten minutes after two, it marked 21½ (71½ of Farenheit); at three, 21¾ (72 of Farenheit); at four, 23 degrees (74 of Farenheit); at five, 24 (76½ of Farenheit); at ſix 25 (78 of Farenheit); at ſeven, 25¾ (79 of Farenheit); at eight, 26 (80 of Farenheit); at nine, 27 (82 of Farenheit); at five o'clock in the morning, it marked 29½ (86 of Farenheit); at half an hour paſt ſeven, 30 (87 of Farenheit); at fifty minutes after ten, 30¾ (88 of Farenheit); at three quarters after twelve, 31 (89 of Farenheit); at half an hour after four, 31½ (90 of Farenheit); at ten minutes after ſeven, 32 (91 of Farenheit); at fifty minutes after nine, 33 (93 of Farenheit); and at five o'clock in the morning, 33½ (94 of Farenheit). At eleven, the heat having begun to abate, the thermometer was taken out of the tube, and placed upon the corn, where the heat was the ſame as within the tube: and laſtly, the corn was taken out of the oven. This experiment ſhews that 49 hours were requiſite for the heat of the oven to penetrate to the centre of that heap of corn. As to the butterflies in the cup, all of them were dead.

About thirty of the grains taken out of the cup being thrown into water, only one ſwam, and that becauſe it contained a dead chryſalis: ſo that a heat of 33 degrees was ſufficient to kill the butterflies and aureliæ. It therefore is, as was obſerved before, better to let the corn continue long in a middling heat, than to make it undergo a great and not laſting heat.

M. de Cers ſowed thirty grains of wheat taken out of the cup, without ſteeping them in water; 30 grains of the ſame corn ſoaked twenty-four hours; and 30 grains which had lain cloſe to the outſide of the tube. All theſe grains grew perfectly well; and the only difference that he obſerved between them was, that thoſe which had been ſteeped ſprouted firſt.

He could not know exactly at what degree of heat the butterflies died, becauſe the cup they were in chanced to be looſened from the ſtick which was intended to draw it out, ſo that he could not examine it till the end of his experiment, when he found them all dead. This determined him to repeat the ſame experiment with 2500 pounds of barley, which he put into an oven heated to 80 degrees of Réaumur's (211 of Farenheit's) thermometer. At four o'clock in the afternoon, the temperature of the air in the tube being at 22 degrees of Réaumur's thermometer (72 of Farenheit's), he put into it the cup, in which he had incloſed both butterflies and weevils. At fifty minutes after five, the thermometer marked 24 degrees (76 of Farenheit): the inſects were well. At fifty minutes after ſix, the thermometer was at 24 degrees $\frac{1}{4}$ (77 of Farenheit): all the butterflies were alive. At three quarters after nine, 25 degrees $\frac{1}{2}$ (79 of Farenheit): all the butterflies yet alive. At half an hour after four in the morning, 32 degrees (91 of Farenheit): all the butterflies

ſtill living. At half an hour after five, 33 degrees (93 of Farenheit): two butterflies dead; all the weevils alive. At eight o'clock, 34 degrees (94 of Farenheit): only the two butterflies before mentioned, dead. At ten o'clock, 36 degrees (98 of Farenheit): four butterflies dead. All in the ſame ſtate at half an hour paſt four in the afternoon. At three quarters after ſix, the thermometer marked 40 degrees (103 of Farenheit), and almoſt all the butterflies were dead. At half an hour after nine, 41 degrees: only the butterflies dead. At five in the morning, 42 degrees½ (110 of Farenheit): the weevils dead. Thus, thirty ſeven hours were ſufficient to kill the inſects. But it ſhould be conſidered, that as the grains of barley are bigger than thoſe of wheat, and conſequently leave larger ſpaces between them, the heat probably penetrated ſo much the ſooner through thoſe interſtices to the tube. Theſe grains grew very well.

M. de Cers made a third experiment, in which he put, at five o'clock in the evening, 1400 pounds of wheat into an oven heated to 96 degrees of Réaumur's thermometer (240 of Farenheit's): but he did not place the thermometer in the tube till the heat was abated to 76 degrees (203 of Farenheit), which was not till an hour after. He then put into the ſame tube two cups, in one of which were weevils, and in the other butterflies. He ſeparated them in this manner, becauſe he had obſerved that the weevils harraſſed and fatigued the butterflies by their violent fluttering. At half an hour after nine, the thermometer marked 24 degrees (76 of Farenheit): at half an hour after five in the morning, 32 (90 of Farenheit): at eight, 34⅓ (93 of Farenheit). All the inſects were then alive: the weevils ſeemed to be ſomewhat giddied; but they recovered

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after having been expoſed to the air for a while. They were replaced in the tube. At one o'clock, Réaumur's thermometer marked 35½ degrees (95 of Farenheit's), and all the inſects were alive. At three quarters after nine it was at 40 degrees (105 of Farenheit), and all the inſects were dead. Here the heat penetrated into the tube ſooner than in the other experiments, becauſe the quantity of corn was leſs.

M. de Cers, after aſcertaining by the above experiments the degree of heat which will kill the butterflies and weevils, extended his reſearches to the caterpillars and aureliæ incloſed in the grains. To this end he put 1200 pounds of corn into a well ſwept oven, an hour and a half after the bread had been drawn out of it. The heat of this oven was then at 100 degrees of Réaumur's thermometer (249 of Farenheit's). He would not wait till the oven was grown cooler, becauſe he had obſerved that the corn chills it ſo much, eſpecially when a conſiderable quantity is put in at once, that the thermometer marks only the ſame temperature as the air of the bake houſe when it is firſt placed in the tube in the heap of corn. He put into a cup both barley and wheat in which there were aureliæ. Every thing was diſpoſed as in the former experiment; excepting that a number of grains known to contain aureliæ were wrapped up in a paper, and put into the middle of 200 pounds of wheat, in a ſack, which was laid cloſe to the tube in the centre of the heap. The oven was ſhut at half an hour five in the evening. At eight, Réaumur's thermometer marked 16 degrees (61 of Farenheit). The next day, at ſeven in the morning, it was at 32 (91 of Farenheit); at five in the evening, at 38 (101 of Farenheit); at half an hour paſt nine, at 42 (109 of Farenheit; the next day, at eight in the morning,

at 43 (111 of Farenheit); at ſix in the evening, it was fallen to 42 (109 of Farenheit); and half an hour afterwards, to 41 (107 of Farenheit). As the heat diminiſhed thus ſenſibly, the corn was not taken out till eight o'clock in the morning of the third day, when, Réaumur's thermometer being at 32 degrees (91 of Farenheit's), the aureliæ were dead: a proof of which was had by putting ſome of them into a ſmall microſcrope, with others which had not been in the oven: theſe laſt ſtirred viſibly, while the others remained motionleſs. To be ſtill more certain that theſe aureliæ were dead, M. de Cers kept them a month, at the end of which they were quite hard and dry; whereas thoſe which had not undergone the like trial of an oven, were full of moiſture, and only numbed by the then cold weather.

The corn that was in the ſack, grew perfectly well. Therefore, if ſuch a quantity as the above-mentioned is put into an oven immediately after it has been threſhed, and an hour and a half after the bread has been drawn; and if that which is intended for ſowing is ſtowed in a ſack in the middle of the heap, and left in the oven at leaſt 48 hours; the farmer will be ſure of having ſeeds free from inſects.

Half the quantity of fuel commonly uſed to bake bread, will heat an oven ſufficiently for the drying of corn.

The ſame method will prove equally effectual to preſerve corn from being eaten by the falſe moth, or any other inſect. Only it is to be obſerved, that when the quantity is conſiderable, the heat of the oven muſt be 80, 90, or even 100 degrees of Réaumur's thermometer (210, 230, or near 250 of Farenheit's), which is that of moſt ovens two hours after the bread has been drawn and the oven ſhut again; and that the corn muſt remain in the

the oven at leaſt twice 24 hours. Corn dried in a ſtove will be well cured in 24 or 36 hours with a heat of only 45 of 50 degrees of Réaumur's thermometer (from 105 to 123 of Farenheit's); becauſe it is there ſpread much thinner, and conſequently preſents a larger ſurface to the heated air.

By following the above directions, each individual may certainly preſerve his corn from the ravages of theſe or any other ſimilar inſects, which prey opon it: but, for the public, where whole provinces may be in danger of being deſolated by this dreadful ſcourge, and where nothing leſs than the joint and careful efforts of all can poſſibly remove the cauſe of the evil, either by a total extirpation of the inſects, or by a great diminution of their numbers; the vigilance and activity of the magiſtracy becomes highly neceſſary: otherwiſe, two or three obſtinate or idle peaſants may ruin their neighbours, with only a few buſhels of infected grain perverſely kept without having been properly cured. So vaſt and rapid is the increaſe of theſe inſects, that amazing ſwarms of butterflies, engendered in a very ſmall heap of corn, will ſoon overſpread the adjacent fields, and infect every ear with their peſtiferous eggs. Coercive means muſt therefore be recurred to, in caſe of need, in ſuch extremities as theſe: all barns, granaries, &c. muſt be ſubject to proper inſpection; ſtrict orders muſt be given, that no corn be kept after a certain time, without having been duly cured; every delinquent, whoſe obſtinacy endangers the public welfare, ſhould be rendered liable to condign puniſhment; and no corn ſhould be ſuffered to be ſent out of the country where the infection prevails, till after it has been rightly cured. At the ſame time, for the ſake of the poor, and that the idle and indolent may have no excuſe, large ovens, or ſtoves, ſhould be erected

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in proper places, at the expence of the public, and the corn ſhould be cured there, at as ſmall an expence as poſſible, or even *gratis*.

It is, however, to be obſerved, that the total deſtruction of the inſect does not require ſuch immediate haſte as the preſervation of the corn itſelf after it has been reaped in a country ſubject to this calamity: for as it is certain that the butterflies do not begin to quit the granaries till near the latter end of May; every farmer has ſeven or eight months time to cure his corn, either in a ſtove or oven, by which he will prevent, ſo far as relates to him, the formidable flights of thoſe deſtructive creatures. Exhortations may therefore ſuffice from harveſt time till April: but after the beginning of this month, no indulgence whatever ſhould be ſhewn to any one who perſiſts in keeping even the ſmalleſt quantity of corn that has not been properly cured.

One remark more will conclude this ſubject, the importance of which will apologize for the length of the foregoing detail, with thoſe who conſider that the means here pointed out for deſtroying a particular inſect, perhaps hitherto peculiar to a ſingle province, are equally applicable to the weevil, to every ſpecies of moths, and to the whole race of various inſects which prey upon and deſtroy corn in all countries. This remark is, that as the inſects before ſpoken of are known ſometimes to riſe out of the ground in the ſhape of butterflies, it will be right to waſh in a proper lye, in the autumn, and afterwards to cover with aſhes, the grain intended to be ſowed in the enſuing ſpring.

It would be vain to ſuppoſe that any care or precaution can poſſibly deſtroy the whole race of theſe butterflies in one year. Some of them will eſcape the utmoſt diligence, wherever they abound. But,

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by following the above directions, their numbers will be viſibly diminiſhed after the firſt year; and juſt hopes may then be entertained, that the ſame means will at length effect, nearly at leaſt, if not totally, their wiſhed for extirpation.

There have been inſtances, and Meſs. Duhamel and Tillet mention [c] one in particular, of theſe inſects hiding themſelves in hollow trees, in the winter. Many other miſchievous inſects are known to do the ſame; and we frequently ſee the boughs of trees and buſhes, particularly thoſe of hedges, covered, eſpecially at their joints, with webs, which are their neſts, filled with their eggs. Theſe ſhould, by all means, be cut off and burnt, to prevent their vaſt increaſe; or thoſe parts ſhould be well rubbed with a hard bruſh, and waſhed with a ſtrong lie.

CHAP. IV.

Of the Preservation of Corn.

IN many parts of the ſouth, where the ſun is very powerful, and the harveſt-ſeaſon generally dry, the common cuſtom is to threſh and winnow the corn as faſt as it is cut down, upon a floor made in the open air; or, which is oftener the caſe, to tread it out, by means of oxen, cows, horſes, mules, and even aſſes, when the quantity is not great. In this laſt operation, the ſheaves, after being opened, are ſpread in ſuch manner that the ears of the corn are laid as much uppermoſt as poſſible, and a man, ſtanding in the centre, holds the halters of the cattle, which are made to trot round, as in a manege; whilſt

[c] *Addition à l'hiſtoire de l'Inſecte de l'Angoumois, p.* 305.

other

other men, with forks, ſhake the ſtraw up from time to time, and the cattle are trotted over it again and again, till they have beaten out all the grain. This method is expeditious enough: but, beſides bruiſing a conſiderable deal of corn, it requires a great many cattle, and ruins the legs of the horſes and mules, which are preferred before cows and oxen, for this work. In threſhing in the open air, two, three, or more families frequently join their labour, for the ſake of greater riddance, immediately after harveſt; and in this caſe one often ſees ten or twelve fails working together upon the ſame floor [a].

In countries where the weather is leſs ſettled, the corn is moſt commonly laid up in the ear, either in ſtacks or barns. The manner of making the former, and the advantages attending them, particularly with regard to wheat, which keeps better in ſtacks than any other way, have been ſpoken of in the firſt volume of this work *; to which I ſhall only add, that where the barns are largeſt, the ſtacks are generally the ſame, and ſo on the contrary; that the ſtacks ſhould always be placed upon a dry eminence, and be well fenced againſt cattle; that when the huſbandman has begun to uſe a ſtack, he ſhould houſe the remainder of it as ſoon as poſſible (for which reaſon it is moſt eligible to make them ſmall and more numerous); and that ſtacks rightly managed ſave a great expence in otherwiſe neceſſary buildings.

To make the threſhing floor abovementioned, and nearly the ſame is frequently practiſed for the floors of barns, the ſurface of the intended threſhing place is dug away to the depth of about ſix inches, and the earth thus taken off, after being

[a] DUHAMEL, *Eléments d'Agriculture, Tom.* I. *Liv.* 4. *c.* 3.

* Page 403 & *ſeqq.*

well

well cleared of ſtones, is mixed with the ſtrongeſt clay that can be had, and with dung of cows or oxen. This mixture is then worked together with water, till it is of the conſiſtence of ſtiff mortar, and the compoſt thus made is ſpread as ſmooth as poſſible, with a trowel, upon the ſpot from which the earth was taken. As it cracks in drying, it muſt be beaten down with great force; or rolled with a heavy roller, till all the crevices are filled up; and this muſt be continued till it is quite ſolid, hard and firm. The floor thus made muſt be carefully fenced in, if it be in the open air, and it will want repairing every year.

The beſt barn-floor, both for threſhing and for keeping of corn, is that which is drieſt, ſmootheſt moſt completely ſolid, and conſequently freeſt from cracks and holes, in which inſects or vermin may ſhelter themſelves, and even breed. The ancients were remarkably careful in this reſpect, as we learn from Cato, Varro, and Columella, the laſt of which excellent huſbandmen relates particularly [a] the great pains they took, firſt to dig up the ground to ſome depth, in order to moiſten it with freſh lees of oil, but not with any that had ſalt in them; then to mix it thorough with chaff, and ram it down as cloſe as poſſible; afterwards, as it dried, to ſtop all the cracks and crevices that appeared; to continue beating it down with great force; to render it quite level; and laſtly, to ſtrew it again with chaff, which they trod in, and then left it to be completely dried by the ſun. All theſe writers agree, that the lees of oil, thus uſed, prevent the growth of weeds in theſe floors, and contribute to preſerve the corn from being plundered by mice and ants. Their barns were always ſeated high, and as dry as poſſible.

[a] *De Re ruſtica, Lib.* II. *c.* 20.

A floor made in the above manner muſt be greatly preferable to either the ſtone or the common earthen floors too common in many parts of England, and from which ſuch dampneſs has been communicated to the corn, as has rendered wheat, for example, ſixpence a buſhel the worſe, either for keeping or exporting[b]. Boarded threſhing floors, made of ſound, thick, well ſeaſoned planks of oak, are excellent for ſervice, will laſt a long time, and may be converted into good floorings for rooms, by planing them down, after they are become too un-even for their former purpoſe: and as to the barn itſelf, which this ſubject naturally leads me to, the building, beſides having a very dry ſituation, ſhould be placed on one ſide of the farm yard, but not quite contiguous to the houſe, from fear of fire from this laſt. It is uſually made of wooden frames covered with planks of oak, or built of brick or ſtone, which ever the country beſt affords; and in either caſe, there ſhould be ſuch vent-holes, or openings, in it's ſides or walls, as to afford free admittance to the air, in order to prevent the mouldineſs that would otherwiſe ariſe from the leaſt dampneſs lodged in the corn. The gable ends may always be of brick or ſtone, for the ſake of greater ſolidity, and the whole may be roofed with thatch or tiles, as is moſt convenient. The ſize of the barn ſhould be proportioned to the crop uſually produced by the farm, or land, to which it belongs. Two large folding doors ſhould face each other, one in each ſide, for the convenience of carrying in or out a waggon load of corn in ſheaves; and theſe doors ſhould be of the ſame breadth as the threſhing floor, to afford the more light and air; the former for the threſhers, and the latter for winnowing.

[b] LISLE's *Obſervations in Huſbandry*, *Vol.* I. *p.* 344.

Over the threſhing-floor, and a little above the reach of the flail, poles are often laid a-croſs from one beam to another, to form a kind of upper floor, upon which the threſher may throw his ſtraw or haulm, to make an immediate clearing, till he has time to ſtow it more properly elſewhere: and on the outſide, over the great doors, it will be right to form a large pent-houſe, made to project ſufficiently to cover a load of corn, in caſe a ſudden ſtorm comes on before it can be houſed, and alſo to ſhelter the poultry in the farm-yard, in great heat, or bad weather.

It is moſt adviſeable, and indeed moſt commonly practiſed in countries which abound in corn, to have a ſeparate barn for wheat, another for ſpring-corn, ſuch as barley and oats, and a third for peas, tares, lentils, clover, ſainfoin, &c.

Some art, which muſt be the reſult of practice, is required in the placing and piling up of the ſheaves, both in ſtacks and in barns. The former has been ſpoken of *; and in regard to the latter, the ſheaves ſhould, as much as poſſible, be preſſed ſo cloſe to the walls of the barn, as not to afford the leaſt room for rats, or other vermin to creep in between them: for if they once get admittance, they will ſoon penetrate farther, lodge themſelves in the mow, and do vaſt damage to the corn. Where this misfortune happens, the only remedy is to take down the mow, kill the vermin, and pile it up anew.

As the farmers in many places feed their cattle, and particularly their ſheep, in the winter, with half-threſhed ſtraw [d]; and as new ſtraw is good food for horſes, which are induced to eat it very readily when it ſtill contains ſome grain; there is,

* See *Vol.* I. *p.* 404.

d DUHAMEL, *Eléments d'Agriculture, Tom.* I. *Liv.* 4. *c.* 3.

in

in this reſpect, an advantage in threſhing the corn only by degrees; beſides that the grain itſelf is allowed to improve in it's quality when preſerved in the ear, ſo as to attain the moſt perfect maturity, to ſweat out it's moiſture, and to acquire a degree of hardneſs which fits it for long keeping. About three months after it has been cut, is generally reckoned the beſt time for threſhing wheat that is intended for keeping; and accordingly our prudent husbandmen make this the buſineſs of winter, when their preſence is leaſt wanted in the field *. But, on the other hand, ſeed wheat cannot well be too ſoon cleared from the chaff, as M. de Chateauvieux's experiments have proved †; and the beſt way of doing this, is by ſtriking the ears againſt a beam, as was ſaid before ‡. By this method the husbandman will obtain fine, long, unbruiſed ſtraw, fit for binding up his next years ſheaves, for thatching, and for various other uſeful purpoſes. Of this he ſhould always ſave, and ſtack, as much as he can ſpare, when it proves long and good; for wheat ſtraw will keep perfectly well a year or two; and if there be no occaſion for it in that time, it will make litter and dung at laſt. Barley-ſtraw is likewiſe very ſerviceable for thatching, or to throw over ſtacks of barley, or peas,, till they can be thatched: but oat-ſtraw is of no great uſe, unleſs it be to cover an oat-rick, peas for fatting hogs, or corn for fowls. In general, an empty ſpace, ſhould be left in the barn, if it can be done conveniently in harveſt time, to receive the litter, and foddering ſtraw, that is threſhed out before cattle come to fodder; or it ſhould be laid under ſome cover, for otherwiſe it will rot.

* Mr. Mortimer ſays, that no wheat threſhed before March is fit to keep long, nor rye threſhed before Chriſtmas, though it has been laid in perfectly dry. *Art of Huſbandry, Vol.* I. *p.* 148.

† See *Vol.* I. *p.* 292, & *Vol.* II. *p.* 246. ‡ *Vol.* I. *p.* 291.

Though

Though the flail be the beſt inſtrument yet known for threſhing of corn, becauſe it ſeparates the grain from the ſtraw and huſks very effectually and expeditiouſly; yet, as it always bruiſes a great many ſeeds, even ſo as to render them incapable of growing, it were much to be wiſhed that ſome method could be found, by which this eſſential inconvenience might be avoided. Some engine or other, provided with a number of flails, or other pieces anſwering the ſame end, might ſurely be made to move by water, wind, or a horſe, ſo as to perform the buſineſs of threſhing ſtill cheaper and more expeditiouſly, and with leſs damage to the health of the husbandman, which is frequently thought to be injured by the duſt, &c. which ariſes in the common way of threſhing, as well as by the very great laborioufneſs of the work. This well deſerves the attention and endeavours of ſkilful mechanicians. At all events, the threſher ought not to wear thick iron-clouted ſhoes whilſt he is at work, eſpecially if he is to threſh new corn, and particularly wheat; becauſe they will be apt to bruiſe it. His ſhoes for this buſineſs ſhould be ſoled with an old hat, or ſome other ſoft ſubſtance.

Mr. Mortimer[d] eſteems it a day's labour for a man to threſh four buſhels of wheat or rye, ſix buſhels of barley, five buſhels of oats, or five buſhels of beans and peas, if the corn threſh well. But Mr. Liſle ſays[e] a good threſher aſſured him, that twelve buſhels of oats or barley are reckoned a good day's threſhing; that this very man had threſhed fourteen buſhels of oats daily, and winnowed them, for ſeveral days together; but that thoſe oats yielded indeed extraordinary well: that five or ſix buſhels of wheat are a very good day's threſh-

d *Art of Huſbandry, Vol.* I. *p.* 151.

e *Obſervations in Husbandry. Vol.* I. *p.* 345.

ing; and if the corn be clung, and yields ill, ſometimes three buſhels are as much as can be threſhed in a day. He rates the common price of threſhing at eightpence for a quarter of corn; and obſerves, which may account for the difference between his eſtimate and Mr. Mortimer's, that ſix buſhels of wheat of the growth of a warm gravelly vale are as eaſily threſhed in a day, as four buſhels of the produce of cold hilly land; becauſe the ſtroke of the flail muſt be forced down ſtronger to beat out the grain of this laſt, then it need to be for the former: and alſo, that as the ſtraw of corn of the growth of a light ſoil is ſhorter than that of a ſtrong clayey ground, more ſheaves, and conſequently more ears of this firſt ſort may be laid together on a floor of equal extent, than can be of the laſt, whoſe longer ſtraw requires proportionably more room.

The worſe wheat is, though it be never ſo dry, the rougher it will feel when handled; becauſe thin and coarſe wheat is not ſo plump and globular as fine wheat, but is apt to be pitted and wrinkled, which of courſe renders it leſs ſlippery. It will handle cooler out of a ſtack two years old, than it will out of one that is only a year old: for in that time the miſts and rimes, eſpecially in a hilly country, will be driven into the ſtack.

Mr. Liſle, who makes this remark, adds[f], from his own experience, that wheat threſhed in damp weather generally yields but little flour, with a great deal of bran, when it is ground; and that if it be put into ſacks, it will grow muſty in leſs than three weeks, let the weather be ever ſo dry afterwards: but if it be threſhed when the air is perfectly clear and dry, it will keep well in ſacks, for a long time; eſpecially if theſe are laid upon

[f] *Vol.* I. *p.* 268 and 346.

treſtles

treſtles high enough to ſecure them from the dampneſs of the ground or floor.

For the keeping of meal, in general, there is no better way than firſt to bolt it, and clear it from the bran, which is very apt to corrode and putrify it, and make it muſty; then to tread it down as hard as poſſible, and head it up cloſely, in clean, dry, tight, and well bound caſks, which muſt be laid in a cool dry place.

The beards of barley come off beſt, in threſhing, when the ſwarths of this corn have taken the dew before their being houſed. It will keep well in the mow, un-threſhed, for one year; and for making it into malt, which muſt be done before the heat of the ſummer comes on, it ſhould not be kept above a year and a half, or at moſt two years: otherwiſe it will be filled with weevils; unleſs it has been previouſly cured in a ſtove or kiln.

Oats, being defended with a double huſk, are the grain leaſt ſubject to harbour vermin. The beſt way to keep them after they are threſhed, is to dry them well on a kiln, and then to barrel them up in clean cloſe caſks: but they ſhould not be threſhed earlier than Chriſtmas, becauſe they are not fit for keeping before that time.

Beans and peas always threſh beſt after they have ſweated in the mow, which they are very apt to do, becauſe, as the whole crop of either of them never ripens all together, the green parts heat, and communicate their ferment to the whole heap. The danger to be guarded againſt here is, that the ripe ſo heated do not give fire to the green, by which both might be either rotted or conſumed; to which the bigneſs of their leaves, and hardneſs of their ſtalks, which continue moiſt and ſappy a long time, will alſo contribute very much. For this reaſon farmers generally chooſe to ſtack them with-

out doors, rather than to houſe them; that they may be the more thoroughly dried by the ſun and air. But the beſt way of all is to kiln-dry them, or dry them well in the ſun; after which they will keep many years, without turning or any other care, though they be laid ever ſo thick in the granary. As beans are a very large ſeed, and conſequently full of moiſture, it is found beſt to let thoſe that are intended for keeping ſweat in the mow till March, when they may be threſhed without danger: for beans never give again, after they have once been thoroughly dried.

Peas are, of all grain, the moſt ſubject to rottenneſs and imperfection, becauſe they are the moſt apt to breed worms, weevils and mites, by reaſon of the luſciouſneſs and ſweetneſs of their grain. The better they are dried, either in the kiln or ſun, the former of which will generally be found moſt effectual in this country, the longer they will keep ſound, and the fitter they will be for the food of cattle, by helping to make them thirſty; it being a juſt obſervation, that if cattle drink well, they will feed well. What is intended for the food of men ſhould not be dried too much; becauſe that would make the peas require double the time in boiling: nor need they be threſhed for this uſe, but as they are wanted; or elſe they may be put into cloſe caſks, and headed up. In granaries, they keep beſt in thick heaps, or in bins; ſpreading of them thin upon the floor being apt to dry them too ſoon, and to take from them much of their ſweetneſs and goodneſs.

Vetches wanted for ſowing immediately after they are cut, may be threſhed very well on a hurdle, with a cloth; though they may then be too ſoft, notwithſtanding their being ripe, to be threſhed on a floor, where the flail, and the threſher's feet, would bruiſe and break them.

When

When a careful huſbandman opens and ſpreads his ſheaves, he will pick out of them at leaſt all the largeſt and moſt apparent weeds, before he begins to threſh. As he proceeds in his work, he will from time to time, remove all the long ſtraw from the corn beaten out of it, which laſt always lies underneath, with a prong or fork; and then the pieces of ſtraw, broken ears, &c. with a wooden rake. He will then ſhovel the remaining grain up on one ſide of the floor, and repeat this till he has threſhed out enough to make what is commonly called a *clearing*.

This heap is then paſſed through a wide ſieve, which retains only the bits of ſtraw, and ſuch fragments or ends of the ears as have eſcaped the flail. Theſe frequently contain very good corn; though the farmer ſeldom grudges giving them to his poultry, or binding them up with ſtraw intended for fodder. A few of them incloſed in a ſmall truſs bound at both ends, the better to keep them in, will entice horſes to eat heartily of this ſtraw, which affords them good nouriſhment: and M. Duhamel judges[a] that they would alſo be excellent and profitable winter food for ſheep, when there is a ſcarcity of graſs.

A great deal of labour may be ſaved in the uſing of this ſieve, by faſtening a loop to it's rim, and reſting it thereby on a hook ſuſpended by a rope. This will ſuſtain half the weight of the corn, and the winnower may eaſily give it the neceſſary circular motion. But a yet more convenient method, is to place a ſquare ſieve, of wire is beſt, with thin boards for it's ſides, upon two poliſhed rods of iron, to throw the corn up into it with a ſhovel, and to puſh it backward and forward

[a] *Eléments d'Agriculture, Tom.* I. *Liv.* 4. *c.* 3.

upon theſe rods, on which it moves eaſily, and will ſift a great deal of corn in a ſhort time.

For ſeparating the chaff, which is the next buſineſs, the caſting-ſhovel is much more expeditious than either the wicker fan, or the common winnow with ſails. When this ſhovel is uſed, the wind muſt blow through the barn, either in at one door and out at the other, or in at a window and out at the oppoſite door. The winnower then, placing himſelf under the wind, and cloſe to the heap of corn that is to be cleanſed, takes it up, one ſhovelful after another, and, with a circular motion, throws it ſcattered in the air, againſt the wind, towards the oppoſite ſide of the barn. The beſt grains, which are the heavieſt, go fartheſt; the leſſer fall ſhort of them; and the very ſmall, ſhrivelled, and much damaged, with the ſeeds of cockle, darnel, and ſeveral other weeds, fall ſtill nearer to the man who throws them; while the lighter ſeeds of other weeds, with the bits of ſtraw, chaff, duſt, &c. are blown from all the reſt, by the wind. From time to time, the winnower quits his ſhovel, and ſweeps away the ſecond ſized corn, which would be too much intermixed with the ſmalleſt, if the heap was left alone and ſuffered to accumulate till the end of the winnowing; and when the whole is done, he ſhovels up the fineſt grain. The leaſt of all, which borders on the chaff, &c. is alſo then collected, and the three ſorts, after being ſifted or ſcreened to cleanſe them from any remaining duſt, are laid up ſeparately; the firſt for ſale, the next for domeſtic uſes, and the third, if the farmer can afford it, chiefly for the food of poultry. The ſhort ſtraws and chaff are ſifted in a pretty fine ſieve, to clear them likewiſe of duſt, and are frequently given to oxen and cows.

Mr. Liſle obſerves that the ſeeds cannot be ſeparated from any grain by the common fan, but that

that it may be done with the ſcreen, of which he therefore adviſes the conſtant uſe for all ſorts of corn deſigned for ſowing [a].

Though wind is, in all caſes, the chief agent in the cleanſing of ſeeds, which being intrinſically heavier than their coats or huſks, are, by the ſame force applied to both, carried to different diſtances, in proportion to their weight, and thereby conſequently ſeparated; yet the natural action of this aſſiſtant is liable to many inconveniences: it blows not conſtantly; but frequently diſappoints the winnower in his time of greateſt need: when it does blow, it is not always in the beſt direction to anſwer the ſituation of his barn; and without doors it is intirely uſeleſs to his purpoſe, if it be not attended with fair weather. Beſides, when it's force can be applied in the beſt way, it is even then not equal; but generally acts by ſudden blaſts, which, as is well known, diſorders the whole work, and occaſions a conſiderable waſte of ſeed [b].

The Dutch avoid theſe inconveniencies by uſing a machine (*PL. II, Fig.* 1.) which creates an artificial wind, uniform and ſteady in it's action, and always ready at command.

The Fan (*Fig.* 2.), which is the acting part of this engine, produces a wind proportioned to the velocity with which it is turned on it's axis, and therefore capable of ſeveral degrees of ſtrength, as beſt ſuits the purpoſe of the winnower.

This fan is incloſed in a large caſe or box, *KL*, and occupies one half of it; which is repreſented ſeparately, and in a different view, in *Fig.* 3. It is ſuſpended freely on it's axis, and turned by the handle *A*. The other half of the box is empty, and receives the ſeed as it falls down from the hopper *B*, to the ſloping floor viſible at *C*, along

[a] *Obſervations in Huſbandry, Vol.* I. *p.* 348.

[b] DUBLIN SOCIETY's *weekly Obſervations, No.* 39.

which it ſlides out at *D*, while the force of the wind which is confined within this winnow, and always acts in the ſame direction, *viz.* lengthways of the machine from *A* to *E*, carries the chaff, light and rotten grains, dirt, &c. out at *E*. In this paſſage, the wind meets the ſeed conſtantly falling from the hopper, and impels it more or leſs toward the end *E*, according to it's weight. Good ſeed never goes quite ſo far, but comes down within the box.

The hopper here is ingeniouſly contrived to ſave labour. It hangs by ſtrings upon four pegs, and moves with ſuch eaſe, that the neceſſary motion may be communicated to it by the ſame hand that moves the fan, without any hinderance to the workman. To this purpoſe, a triangular board *f*, is fixed upon the handle of the fan, and turns with it. The angles of this board, in their rotation, preſs againſt the lower end of a little lath, incurvated as in the figure, which moves freely upon a peg at *g*. This end accordingly recedes from the preſſure towards *H*, and conſequently the upper end moves the contrary way, towards *I*, and by a ſtring faſtened from it to the hopper, draws this laſt after it, out of it's natural ſituation. When this preſſure ends, and the ſides of the little triangle are next to the lath, the hopper hangs freely, returns to it's former place, and takes the lath along with it, till the next angle of the little triangle begins to act; and ſo alternately as long as the fan moves. As the hopper is thus in continual motion, the ſeed ſheds down, and is winnowed as it falls.

The next care is to cleanſe the corn from all foreign bodies which could not be carried off by the wind, ſuch as ſtones, bits of earth, &c. Theſe are ſeparated by running the grain through a ſieve wide enough to let it paſs with eaſe, while bodies of a larger bulk are retained: and it is likewiſe

likewiſe often neceſſary afterwards to uſe a fine ſieve which lets through only the duſt, ſeeds of weeds, and other bodies ſmaller than the corn.

Though we, happily, in this kingdom, are not under the ſame neceſſity as ſome foreign countries, of building large edifices for public granaries, becauſe our harveſts are much leſs apt to fail us; yet as this work is, perhaps too preſumptuouſly, intended for general uſe, it is incumbent on me to ſpeak of thoſe effectual, though expenſive means of guarding againſt dearth, or even famine, as well as of the cheaper and eaſier methods, by which every famer may be enabled to enjoy the advantage of preſerving a large quantity of corn in a ſmall ſpace, without danger of it's heating and fermenting, of it's being preyed upon by deſtructive animals and inſects, or of it's being ſpoiled through the ignorance, or want of judgement, of inattentive ſervants.

Corn reaped in a dry year, and eſpecially that of the growth of a hot country, is well known to be the moſt perfect, and the fitteſt for keeping: as on the contrary, experience has proved that the ſofter and leſs ripened grains of wet years and rainy harveſts ſhould always be diſpoſed of for more immediate uſe, though their too great humidity, which would infallibly occaſion a putrefaction, if not remedied in time, may be exhaled, and they may then be preſerved a long while in very good condition, as will be ſhewn from repeated facts and proper experiments.

The ancient Romans imported annually vaſt quantities of corn from Egypt, a very hot and dry country, ſcarcely ever watered but by the periodical overflowings of the fruitful Nile; and they found this grain anſwer much better than any of their own growth, both for yielding plentiful crops, when ſown in Italy, and for keeping in their public granaries, where they frequently preſerved it many years,

years, perfectly ſound. Pliny tells us [b], that, in his time, they kept corn a long while in ſubterranean caverns, made in a dry ſoil, and ſo cloſely ſtopped that not a breath of air could enter. They then covered the bottom with ſtraw, and laid upon that the corn in the ear. We have the concurrent teſtimony both of the ancients and moderns, that it will keep thus perfectly well for at leaſt ſix or ſeven years; and an accident, not long ago, diſcovered a parcel of corn thus preſerved at Amiens, where, though it had been laid up during a great number of years, it was found to be freſh and good, neither worm-eaten, rotten, nor mouldy. This was certainly owing to the moiſt air having been kept out, and with it the eggs of animals, and ſeeds of thoſe minute vegetables which we ſee in form of mouldineſs on ſuch corn as has been leſs carefully defended from their acceſs. In effect, experimental philoſophy has proved that the air is the great ſource of corruption; for even the moſt corruptible ſubſtances, ſuch as meal, butter, milk, and the like, have been preſerved freſh four months in the exhauſted receiver of an air pump.

There ſtill is, near Grand-Cairo, a vaſt ſubterranean magazine of corn, defended with good walls, and called Joſeph's granaries. It is hardly to be ſuppoſed that they are quite ſo old as the days of that patriarch: but they abundantly prove the utility of ſuch places of ſtore, by the vaſt quantities of grain annually preſerved in them.

Many parts of Africa, the corn of which country, and particularly that about Algiers and Tunis, will keep much longer than the growth of any other place, abound with granaries of this kind. They are deep pits made in the ſolid rock, but juſt wide enough at their top for a man to go down into them,

[b] *Lib.* XVIII. *c.* 30.

but

but they grow larger immediately after, and are uſually ſquares of from thirty to forty feet in diameter. In theſe, the great men of the country preſerve their corn. They firſt cover the floor with ſtraw, then ſpread upon that a layer of corn, upon this another, but thin, bed of ſtraw, then another couch of corn, and ſo on, till the whole cavity is filled; obſerving all the while, as the heap riſes, to place ſtraw between the corn and the ſides of the walls. When this is finiſhed, they cover the mouth of the entrance with a ſort of hurdle, over which they lay about two feet thick of ſand, and over this they raiſe a ridge of earth, well beaten together, in order to throw off the rain both ways, that none may ſettle on the place and ſoak into the magazine. The corn thus ſtored up always keeps three, four, or more years very ſound; and not unfrequently the proprietor being taken off by the cruel deſpotiſm of the Eaſtern governments, the magazine is forgotten, ſome accident diſcovers it many years afterwards, and the corn is almoſt always found perfectly good in it. All the care they take, by way of preparing the grain, is to expoſe it two or three days to the heat of the ſun, to dry it thoroughly before they carry it into the magazine.

In the dutchy of Lithuania, and in the Ukraine, the people always preſerve their corn in nearly the ſame manner, in wells or pits made in dry places: but great care muſt be taken there in the opening of theſe ſtores; for people who have deſcended into them, before they had had ſufficient communication with the freſh air, have been killed by the damps. [a]

The Ruſſians too preſerve their corn under ground, in deep pits of almoſt the figure of a ſu-

[a] DES LANDES, *Trait. Phyſ.*

gar

gar loaf, wide below, and narrow at top. The ſides are well plaſtered, and the top is covered with ſtones. They are very careful to dry their corn well, generally by means of ovens, kilns, or ſtoves, for their ſummer is too ſhort to effect it ſufficiently, before it is laid into theſe repoſitories.

The ſame thing is practiſed with unvaried ſucceſs in the iſland of Malta: and alſo in Gaſcony, the Vivarais, and other ſouthern parts of France, the corn of which is remarkable for keeping many years longer than that of any other province in the ſame kingdom. M. Duhamel tried this method in the Gatinois: but his corn was ſoon ſpoiled there by it's humidity when laid up; that country being ſubject to wet and moiſture, and his grain, in this trial, not having been previouſly dried in an oven or ſtove [b].

Upon the whole, it is evident from theſe, and from many more inſtances, which might be alledged, of the practice of other countries, that ſubterraneous granaries properly made in a thoroughly dry ſoil, are the beſt of all repoſitories for the keeping of corn: but, at the ſame time, experience ſhews that this method will not ſucceed in our climate, the ſun here not having power to exhale the moiſture from the corn, ſufficiently to prevent it's fermenting when laid in a large heap. I muſt likewiſe add, that when one of theſe ſubterranean magazines is opened and expoſed to the air, it muſt be emptied immediately, and the corn taken out of it muſt be thoroughly ſifted and ſcreened, or it will ſoon corrupt. Some think it more nouriſhing, when it has been well preſerved, than that which has been kept in granaries above ground.

The Marquis of Santa Cruz, author of many excellent remarks on the political and military ſtate of different nations, obſerves, that the corn

[b] *Elements d'Agriculture, Tom.* I. *Liv.* 5. *c.* 3. *Art.* 1.

of

of Galicia and the Aſturias will hardly keep from one year to another, becauſe of the humidity it contains, which rots and decays it: but that the corn brought thither from Caſtile will keep good many years. This laſt is therefore the only kind that the Spaniards ever venture to lay up in their public granaries: and the ſole difference, in M. Des Landes's opinion [c], between it and their other ſorts, is, that it grows in a country where there is leſs rain in ſummer. They might indeed, if their religion and policy did not forbid their having intercourſe with the moors of Barbary, once their conquerors, eaſily import from Africa plenty of ſome of the beſt corn that the world affords, perfectly ripened, thoroughly dried, and, in all reſpects, fit for keeping many years.

The great objection to public granaries, even in countries where the uncertainty of the climate, the indolence of the people, the ill-judged form of government, and various other cauſes frequently combine to render them highly neceſſary, is the expence attending ſuch eſtabliſhments; generally ſo great, that none but a monarch, or a ſtate, can properly undertake them: and they, moſt certainly, cannot do any thing more laudable, more truly noble, in countries whoſe misfortune it is to be expoſed to the dreadful calamities of want and famine, or to depend upon the precarious aſſiſtance of their neighbours.

Though ſubterranean repoſitories for the keeping of corn are preferrable to all others in countries proper for them; yet, even the common granaries may, with due care, and perhaps ſome few alterations, be rendered much more ſerviceable than they generally are. The principal cautions neceſſary to this purpoſe are, 1, to guard againſt the

[c] *Traité Phyſique.*

too

too great humidity which always prevails in places where there are many doors and windows: 2, to prevent a too free acceſs of the external air, becauſe this brings in with it the eggs of a vaſt number of different inſects, which prey upon and deſtroy the corn: and 3, to take care that the corn be thoroughly dry, and as clean as poſſible, when it is laid up. Theſe are the three general rules to prevent it's corrupting.

The chief cautions to be obſerved in the erecting of granaries are, to make them ſufficiently ſtrong, and to expoſe them to the moſt drying winds. Sir Henry Wotton and Mr. Worlidge agree particularly in theſe; both judiciouſly adviſing a northern aſpect for theſe buildings, becauſe that quarter is cooleſt and moſt temperate; and the latter rightly obſerving, in general, that the beſt granaries are thoſe built of brick, with quarters of timber wrought in the inſide, whereto to nail well joined boards ſo cloſely to the wall, that there be no room for vermin to ſhelter themſelves. Floors of plaſter are reckoned the beſt, becauſe they are cool in ſummer, and if well made, do not retain dampneſs in the winter. There may be ſeveral ſtories one above the other; for the ſhallower the corn lieth, the better it will keep, and the more eaſily it is turned. Some have a ſmall hole in the floor of their upper granary, through which the corn deſcends into the lower one, like the ſand of an hour-glaſs; and after it is all come down into the loweſt granary, it is conveyed back into the upper one; ſo that it is kept in continual motion, which is a great means of preſerving corn.

The granary in the city of Schönbank, in the vale of Parinburg upon the river Elbe, which is a ſtore-houſe for the wheat of which the mum is made at Brunſwick, is built nearly in this manner.

It

It is three hundred feet long, eighteen feet wide within, has ſeven ſtories, each of which is ſeven feet high, and large windows all around, to open and ſhut cloſe according as the wind ſits. By this means, the droſs and duſt are carried off as the corn is turned; for which a weſt wind is always preferred, becauſe it is the drieſt. At each end of this granary, and in the middle, are ſtoves for fire in damp weather, and at the going away of great froſts and ſnows, to prevent moiſture. There are alſo on each ſide of this building three long troughs or ſpouts, in the upper loft; and in fair weather men throw the corn out of this loft into thoſe ſpouts, through which it falls into others, about ten feet wide at the top, and eight or ten inches at the bottom, by which it is conveyed into the lower ſtory, from whence it is wound up again by a crane fixed in the upper loft. By thus falling from one ſtory to another, the corn is cleanſed by the wind from all duſt and chaff, and receives the benefit of the air, &c. Theſe troughs, or ſpouts, are put on and taken off as occaſion requires, to any of the windows; that when veſſels come to lade corn, it may be conveyed, through them, into the proper barges, without being carried thither by men, or cattle. The wall of the two firſt ſtories is two bricks and a half thick, that of the three next is two bricks thick, and the thickneſs of the two uppermoſt is a brick and a half. Fourteen thouſand quarters of corn may be kept in this granary.

Mr. Mortimer, who gives us this account, which is taken originally from captain Andrew Yarranton's England's improvement by ſea and land[c], adds, that the ears of corn, cut off from their ſtalks, and packed up cloſe in a tight caſk, will keep very well, and that this is the beſt, he

[c] *Page* 135.

indeed

indeed ſays, the only, way of carrying any ſort of corn over the ſea, in order to ſow it in a foreign country [d].

The public granaries at Dantzick are ſeven, eight, or nine ſtories high, and have a funnel in the middle of every floor, to let down the corn from one to another. They are built ſo ſecurely, that the corn does not contract any damp, though they are ſurrounded with water on every ſide, in ſuch manner that veſſels come up to the very walls for their lading, which is let down into them, likewiſe through pipes or funnels, with very little labour and charge. No houſes are ſuffered to be built near them for fear of accidents by fire [e].

At Zurich, in Swiſſerland, corn is kept eighty years, or more, in the public granaries, which are very ſpacious, and well aired by means of many ſquare wooden pipes which paſs through them.

The twelve companies of London, with ſome other companies and private perſons, had formerly their granaries at the Bridge-houſe in Southwark, under the ſuperintendance of a juſtice of the peace, a ſteward, and two maſters: Theſe granaries were built on two ſides of an oblong ſquare (now uſed for a wharf), one of which ſtood north and ſouth, and was near an hundred yards long. Along this ſide were lattice windows which faced the north-eaſt; and on the other ſide, which was about fifty yards long, the windows looked to the north. The oppoſite ſides had no apertures. All the windows were about a yard high, without any ſhutters, and ran on in a continued ſeries, with very ſmall partitions, ſufficient only to nail the lattices to. Each of theſe granaries was three or four ſtories high; but the loweſt, or ground ſtory,

[d] *Art of Huſbandry, Vol.* I. *p.* 146.
[e] *Philoſoph. Tranſ.* No. 25.

which

which was twelve feet high, was uſed only for a ware-houſe.

In Kent, two ſquare holes are made at the end of the floor, and a round one in the middle, by means of which the corn is thrown from the upper into the lower rooms, and back again, the better to turn and air it. The ſcreens uſed on this occaſion are made with two partitions, to ſeparate the duſt from the corn. The duſt falls into a bag, and when it is ſufficiently full, it is thrown away; the pure and good corn remaining behind. By theſe means corn has been kept thirty years in this country: and it is obſerved, that the longer it is kept, the more flour it yields in proportion, and the purer and whiter the bread is; only the ſuperfluous humidity evaporating in the keeping: for grain does not diminiſh in weight or bulk, after the firſt year.

The uſual way of preſerving it in our common granaries is, after it has been well ſifted and ſcreened, to ſpread it upon the floor about ſix inches thick, to turn it twice in a week, and to repeat the ſcreening of it once a week, during the firſt two months. It is then laid a foot thick, for two months more; and in this time it is turned once a week, or twice, if the ſeaſon be damp, and now and then it is ſcreened again. At the end of five or ſix months, it is raiſed to the thickneſs of two feet, turned once a fortnight, and ſcreened once a month, or as occaſion requires. After a year, it is laid two feet and a half or three feet deep, turned once in three weeks or a month, and ſcreened in proportion. When it has lain two years, or more, it is turned once in two months, and ſcreened once in three, and how long ſoever it is kept, the oftener it is turned and ſcreened, the better the grain will be preſerved. An empty ſpace, about two feet or a yard wide, is always left

on each ſide of the corn, to prevent it's running down holes or chinks at the edges of the floor, and to remove it from all moiſture that may proceed from the ſweating of the walls, or from any defect in the roof; and another ſpace is commonly left along the middle of the heap, if it be a wide one, to facilitate the turning of it as often as is needful [f]. This is the general cuſtom; and experience has ſhewn it to be neceſſary in the uſual manner of keeping grain.

But all the foregoing methods of preſerving corn in granaries above ground are attended with very great expence, by reaſon of the vaſt buildings, which they require, and the many ſervants neceſſary to be employed to take care of theſe ſtores: beſides which, too much depends here upon the aſſiduity, ſkill, and probity of thoſe ſervants; and the grain is ſtill liable to be preyed upon, waſted, and ſpoiled, by vermin and inſects.

To obviate theſe inconveniencies, and to point out an eaſier, cheaper, and ſurer way of keeping all ſorts of grain, is the principal deſign of M. Duhamel's excellent treatiſe on the preſervation of corn; in which, after rightly noticing the ſeveral diſadvantages attending the common practice, he propoſes a method founded in reaſon, and on his own repeated experience, as well as that of others, whereby a large quantity of corn may be preſerved in a ſmall ſpace, during a number of years, without danger of it's heating, fermenting, or contracting a bad ſmell or taſte, and ſecure from the ſpoil of animals and inſects, at a trifling expence, and with very little trouble *. All theſe deſireable

[f] *Ibid.*

* The reverend, and truly worthy, Dr. Hales, ever ſtudious to promote the welfare of mankind, propoſes the following method of preſerving corn, as a means which may be very beneficial

deſireable ends may be obtained, in ſome caſes, by ventilation only; in others, by drying the corn in a kiln, oven or ſtove; and in others again, by both theſe methods; as will appear from the following experiments. But, previous to them, it will be right to give a ſhort

Deſcription of M. Duhamel's Granary of Preſervation *for the ſubſiſtence of a middling family* [a]; from which we may form a juſt idea of what is requiſite for larger uſes. *Fig.* 4.

beneficial to the poor, who keep only ſmall quantities of it in ſacks.

"Provide a red-cane, or other hollow ſtick, made ſo by glueing together two ſticks grooved hollow: let it be about three feet nine inches long; and, that it may be the more eaſily thruſt down to the bottom of the corn in the ſack, let it's end be made taper to a point, by fixing therein a wooden plug, which will at the ſame time ſtop the orifice at that end. About an hundred and fifty ſmall holes, of one eighth of an inch diameter, are to be bored on all ſides of the ſtick, from it's bottom, as far as two feet ten inches of it's length; but no nearer to the ſurface of the corn, leſt two great a proportion of air ſhould eſcape there. By wreathing a pack-thread in a ſpiral ſcrew-like form round the ſtick, the boring of the holes may be the better regulated; ſo as to have them about half an inch diſtant towards the bottom, but gradually at wider diſtances, ſo as to be an inch aſunder at the upper part; by which means the lower part of the corn will have its due proportion of freſh air. To the top of the ſtick let there be fixed a leathern pipe ten inches long; which pipe is to be diſtended by two yards of ſpiral wire coiled up within it. Or a tin pipe may be fitted to it for the ſame purpoſe, having a piece of leather faſtened to the other end, to receive the noſe of the bellows. At the upper part of the pipe is fixed a taper wooden faucet, into which the noſe of a common houſhold bellows is to be put, in order to ventilate the corn.

"If corn, when firſt put into ſacks, be thus aired every other or every third day, for ten or fifteen minutes each time, it's damp ſweat, which would hurt it, will, in a few weeks be carried off to ſuch a degree, that afterwards it will keep ſweet with very little airing, as has been found by experience.

"By the ſame means many other kinds of ſeeds, as well as corn, may be kept ſweet, either in ſacks or ſmall bins: but

[a] *Traité de la Conſervation des Grains, p.* 196.

Fig. 4. and 5, *PL. II*, repreſent this granary, which is only a common vat, well hooped, either with wood or iron, and joined as cloſely as if it were to contain liquor. The bottom is ſtrengthened and ſupported by the joiſts *a*, which croſs the ſeams, and are cut down at their ends, ſo as to lie cloſe to it; and around the inſide top of the upright ſtaves is a groove *b*, *Fig.* 4, to receive the boards or ſtaves of the cover *c*, *Fig.* 5. When the upright ſtaves, which form the ſides of the vat, are too thin to admit of this groove, a wooden hoop may be nailed on, ſo as to anſwer the ſame purpoſe: and to ſtrengthen the cover, upon which it may ſometimes be neceſſary for a man to ſtep, two pieces of wood, about two inches and a half or three inches thick, marked by pricked lines in *Fig.* 5, are faſtened under and a-croſs the boards *c*, in which are ſeveral holes or openings *d*, of four or five inches diameter, to let out the air when the bellows are worked: but at other times they are cloſely ſtopped with bungs (*e*), to prevent the entrance of any creature whatever. A ſecond bottom of lattice-work, of wood, covered at top with ſtrong canvas, or hair cloth; or, which may be yet better, becauſe the duſt will be more eaſily ſhaken out of it, a wicker bottom cloſely woven, ſhould be fitted exactly to the breadth of the vat, and reſted upon joiſts, ſo as to leave between it's upper ſurface and the lower bottom, a ſpace of about four inches and a half in height, for wind to be diſtributed throughout: for as it is well known that corn laid up in any conſiderable heap, eſpecially in countries where the air is not perfectly dry, will ſoon ferment and ſpoil, and that this is

for bins the air-holes muſt be made only near the bottom of the canes, becauſe all the air muſt in that caſe aſcend upward, ſince it cannot go through the ſides of the bin, as it will go through ſacks."

beſt

beſt prevented by forcing out the tainted air, and ſupplying it's place from time to time, with freſh; or, in other words, by eſtabliſhing a current of air, which ſhall paſs through the corn, and carry off the dampneſs; ſo the grain depoſited in this vat, or granary, muſt be ventilated at proper intervals. To this end, the common noſle (*i*) of two ſmall bellows (*b b*), or that of a ſingle larger one, is to be ſo fixed between the two bottoms of the granary, by an opening made for that purpoſe, as to convey forcibly into it the air received from without. One man may eaſily work theſe bellows by means of the lever *l*: but even that labour may be ſaved, and when the granary is large it will undoubtedly be moſt adviſeable, by working it with ſwifts, like thoſe of Dr. Hales's ventilators. The beſt bellows for this purpoſe are likewiſe thoſe contrived by that excellent patriot; becauſe they are conſtructed without leather, or any matter liable to be deſtroyed by vermin. The vent-holes at top, out of which the air is forced, after being driven through the whole body of the corn, may, beſides their other ſtopples which are to be taken out at the time of ventilating, be covered with a cloſe wire-lattice, for farther ſecurity againſt vermin.

M. Duhamel calculates [b] that every ſtroke of a large pair of bellows conveys two cubic feet of air into the granary, which at the rate of 420 ſtrokes in five minutes, will ſupply 80640 cubic feet in eight hours working.

The proportion of air in a heap of corn is found to be about one eleventh part: but ſuppoſing it even a third, the whole will be changed 2600 times in eight hours, with only one pair of bellows.

[b] *Ibid. p.* 37.

To theſe computations the ſame ingenious gentleman adds[c] another, extremely intereſting, relative to the difference in point of room, as well as of expence, between his and the common granaries. He ſuppoſes one of theſe laſt 80 feet long and 21 broad, which makes a ſurface of 1680 feet. From this muſt be taken off, for the paſſage and the ſlopeing of the corn, at leaſt three feet on each ſide, which makes ſix feet for the whole length, or 480 ſquare feet. There conſequently remain but 1200 feet: and as at leaſt fifty feet more muſt be deducted from this, for the ſpace neceſſary for turning the corn, and for the paſſage at the other end, the room actually occupied by grain will be 1150, which, at the medium depth of eighteen inches, will contain only 1725 cubic feet of corn. Now one of his granaries of twelve feet cube will contain 1728 cubic feet of corn: and as to the ſaving in the expence, it is ſelf-evident.

It is quite immaterial whether theſe granaries of M. Duhamel's invention are round or ſquare. If the latter, they muſt be made of ſound oaken planks, at leaſt two inches thick, or more, according to their dimenſions, and great care muſt be taken to join them very cloſe. The vent-holes, double bottoms, and manner of applying and working the bellows, are the ſame.

It is of great importance that the corn be well cleaned before it is put into one of theſe granaries of preſervation, as M. Duhamel calls them; becauſe it muſt continue there till it is made uſe of. The ſieves, ſcreens, and winnows before mentioned, do very well in the common way, for corn that is not to be kept a long while, or in this manner: but much nicer cleanſing is neceſſary here; and, above all, great care muſt be taken to guard

[c] *Ibid. p.* 16 and 27.

againſt

againſt the leaſt mixture of ſmutty grains. It will therefore be right, before the corn is thus laid up, to purify it throroughly from all remaining dirt, duſt, chaff, and inſects not actually incloſed in the grains, if any ſuch there be, by paſſing it through the following cylindrical or bolting ſieve, which may alſo be uſed very advantageouſly for the ſame purpoſe, on other occaſions, eſpecially when the corn is fouler than uſual.

A, *Plate II. Fig. 6.* is a cylinder [d] like the bolter commonly uſed for ſifting meal, excepting that it is ſtronger made, of a larger diameter, and, inſtead of linen, is covered with alternate circular rows of tin (*a*) and wire (*b*). The tin is punched through, ſo that it's inſide is like a nutmeg grater; and the wires are laid parallel to each other, as in a ſcreen.

The corn is put into the hopper *B*, from whence it runs into the cylinder, which is raiſed a little at the end next to the hopper. The cylinder is turned with a handle *C*; and it's ſlope makes the corn glide by degrees to the other end *D*, where it falls out. This ſieve, like the common bolters, is entirely covered with a cloth, to hinder the duſt from mixing with the good grain.

The corn, in it's motion here, is rubbed ſo ſtrongly againſt the rough edges of the holes in the tin, while the duſt and ſmall grains drop through the wires, that it is of a far brighter, clearer, and better colour when it comes out at the oppoſite end *D*, than it was when put into the hopper.

This ſieve is particularly excellent to cleanſe mildewed, ſmutty, or ſpotted corn: but the grain muſt ſometimes be paſſed through it pretty often,

[d] *Ibid. p.* 106.

if it be very foul, before it can be rendered quite clean.

As the following experiments ſhew how far, and in what caſes, either ventilation, or the uſe of fire, ſingly, or both of them jointly, may be effectual to preſerve corn; and likewiſe how far either, or both of them will deſtroy the inſects moſt apt to prey upon it in the granary, particularly the moth and weevil; I ſhall only obſerve here, that kiln-drying, or drying in an oven, will anſwer all the ends of M. Duhamel's ſtoves, at a much eaſier charge; and that they are ſufficient for this, or any other country, where the harveſts are not precarious. The curious who can afford to be at the expence of ſuch ſtoves, may find correct drawings, and an accurate deſcription of them, in his treatiſe on the preſervation of corn [e], and in his Elements of Agriculture [f].

That corn may be dried perfectly well in an oven, that it may be dried there to whatever degree is neceſſary in order to exhale the moiſture which is a principal cauſe of it's corrupting, and that the ſame means will alſo kill any inſect in it, appears from various parts of the preceding inſtructions and experiments of Meſſieurs Duhamel and Tillet, for deſtroying the corn-caterpillar in the province of Angoumois *: and as to the kiln, Mr. Tull inſtances [g] a neighbour of his in Oxfordſhire, who acquired a large fortune by drying his wheat on a hair cloth, in a malt-kiln, with no other fuel than clean wheat-ſtraw, the heat of which he never ſuffered to exceed that of the ſun. The longeſt time he let it remain in this heat, was twelve hours; and the ſhorteſt time,

e *Page* 119 — 194. f *Tom.* I. *Liv.* 5.

* See *p.* 73 — 93.

g *Horſe-hoeing Huſbandry*, *p.* 131.

was

Fig. 1.

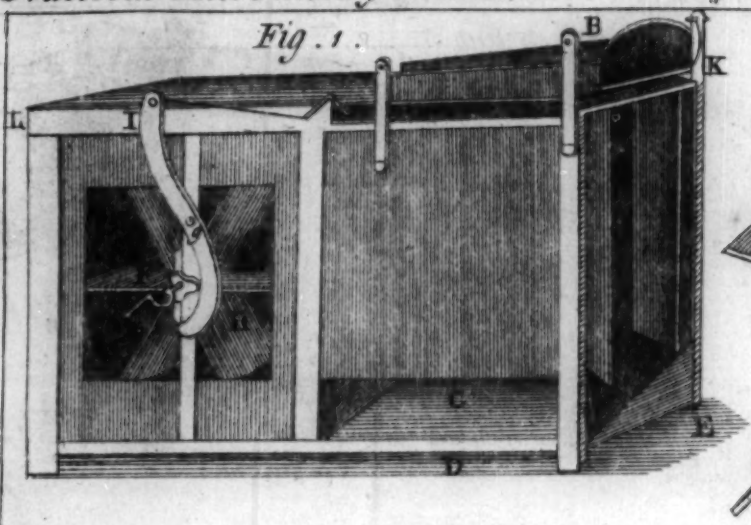


Fig. 5.

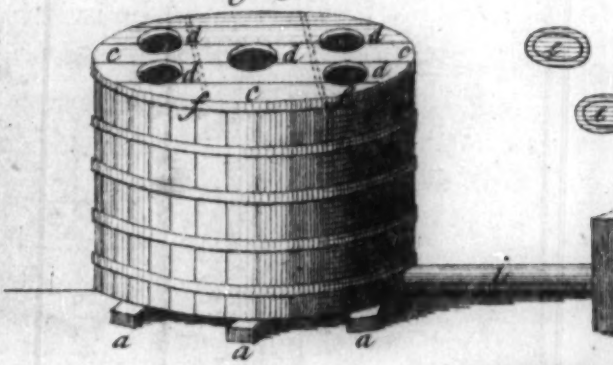


Fig. 4.

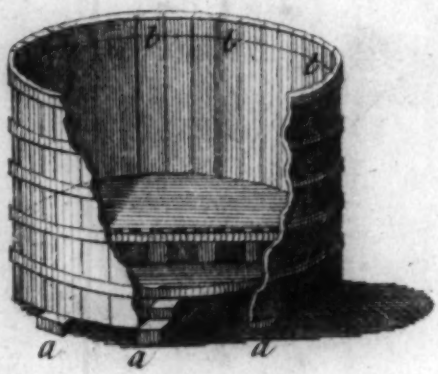




Fig. 2.

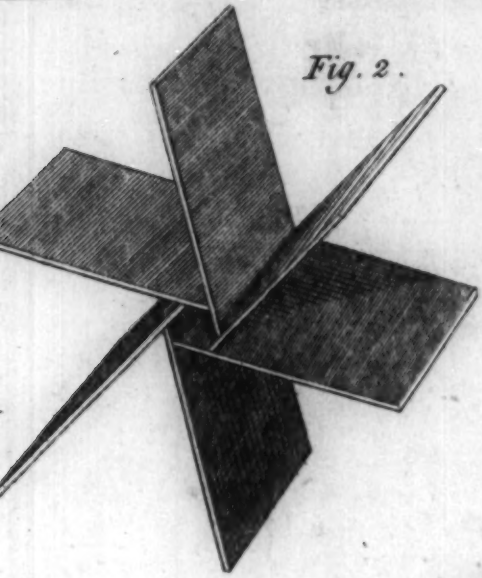


Fig. 3.



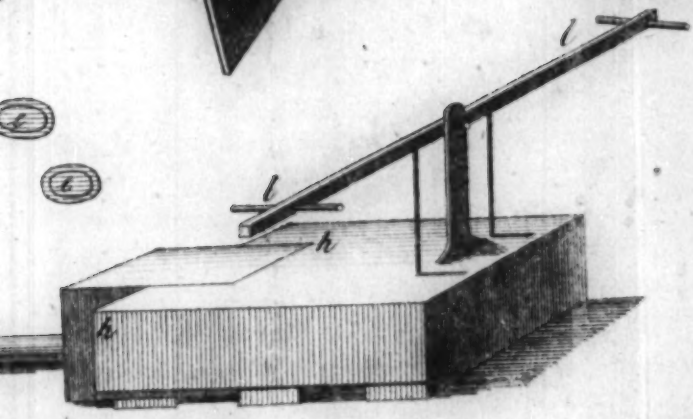
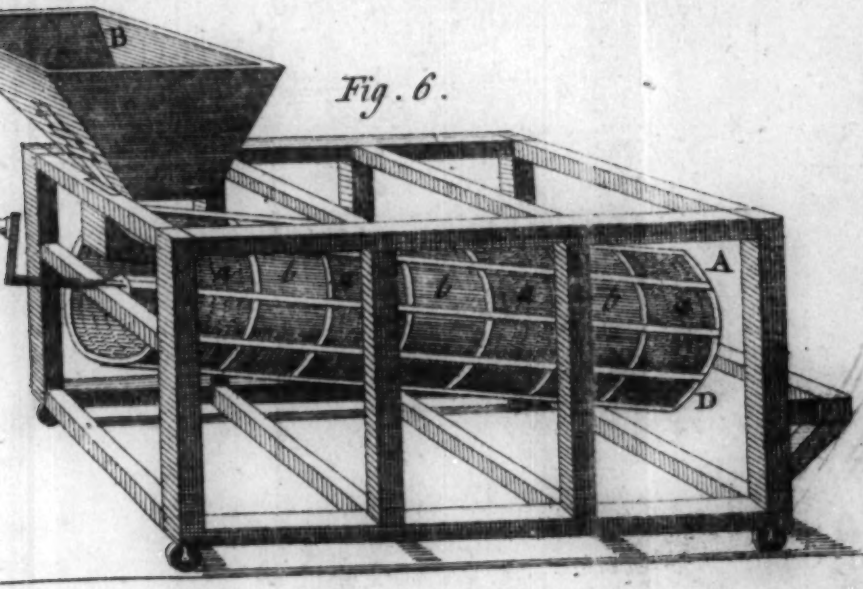


Fig. 6.



was about four hours. The damper the wheat was, and the longer intended to be kept, the more drying it required; but how to diſtinguiſh nicely the degrees of dampneſs, and the number of hours neceſſary for it's continuance in the kiln, was an art, ſaid the farmer, impoſſible to be learnt by any other means than practice.

Corn, though ſeemingly dry, contains a great deal of moiſture, as is evident from it's marking at leaſt the floor on which it has lain, and as M. Duhamel experienced very ſenſibly, when, having put new corn into glaſs bottles well ſtopped, the moiſture that came out of it appeared on the inſide of the bottles, and the grain grew mouldy [h]. We have alſo here a manifeſt reaſon why, let the weather be never ſo hot at harveſt, the uppermoſt ſheaves of a heap are harder to threſh than thoſe which lie at the bottom. This is evidently the conſequence of moiſt vapours that riſe from the corn. Again, if a large heap of corn is laid up in a granary, and not ſtirred for a conſiderable time, or if only a barrel be filled with it; after ſome time, upon running one's hand into it, one will feel a ſenſible heat, with a ſmall moiſture: it next acquires a vinous ſmell, then turns ſour, and at laſt mouldy; in ſhort, it ferments, and is no longer fit to make bread, and ſometimes even the fowls will not eat it [i].

This moiſture muſt therefore be removed before corn can be laid up with ſafety, for any length of time: and as the ſun has not power to exhale it in a climate like our's, recourſe is to be had to fire. The weight of the corn is indeed conſiderably diminiſhed hereby; but it's vegetative power need not be at all impaired, as ſeveral facts mentioned in in the foregoing account of the corn

h *Traité de la Conſervation des Grains, p.* 18. i *Ibid. p.* 21.

cater-

caterpillar have proved, and as it is farther evinced by the following.

In the autumn of the year 1745, M. Duhamel weighed a quantity of wheat of the preceding harveſt, and expoſed it for twelve hours to the heat of a ſtove which made M. de Réaumur's thermometer riſe to 50 degrees (123 of Farenheit's) *: it loſt an eighth of it's weight, and yet was only dried; for being ſowed, it came up.

He likewiſe put ſome wheat of the harveſt of 1744, and ſpring corn of the harveſt of 1742 †, in a ſtove heated ſo as to raiſe M. de Réaumur's thermometer to 38 degrees (101 of Farenheit), which, ſays M. Duhamel, is eight degrees of Réaumur's (15 of Farenheit's) higher than it riſes in our very hotteſt ſummers ‡. Both the ſorts of corn uſed for this experiment loſt a two and thirtieth part of their weight in twenty four hours. They were put again into the ſtove heated to 51 degrees of Réaumur's thermometer (125 of Farenheit's) and their weight was diminiſhed very near one ſixteenth in twenty four hours. Other parcels of wheat, ſome old, and ſome new, were dried, purpoſely to try what dedree of heat would deſtroy it's power of vegetating. Some underwent a heat of 12½ degrees of Réaumur's thermometer (54 of Farenheit's) ſome 38 (101 of Farenheit), and ſome 51 (125 of Farenheit). In all theſe caſes, the new came up, but the old did not [k].

* This is a height to which the liquor of a thermometer ſcarcely ever riſes when expoſed to the hotteſt ſun, *Conſervation des Grains*, *p.* 18. note *a*.

† The corn of both theſe crops was houſed very dry. *Ibid. p.* 19. note *c*.

‡ When the thermometer is ſet in a ſhady place, as it generally is for the making of obſervations. *Ibid. p.* 19. note *d*.

k *Ibid. p.* 20.

In

In general, it certainly is moſt advantageous to unite the kiln-drying and ventilation, not only becauſe they are moſt effectual to preſerve corn, when joined together, but alſo becauſe they are then leaſt coſtly and leaſt troubleſome: for to kiln-dry, and much more to ſtove-dry, it ſufficiently to keep without ventilation, requires a great deal of fire and much attendance; and to preſerve it without kiln-drying, will require very frequent ventilation; whereas, by joining the two methods, both are rendered very eaſy and leſs expenſive, and the ſucceſs is more certain.

EXPERIMENTS ON THE PRESERVATION OF CORN BY VENTILATION ONLY; *with remarks thereon.*

M. DUHAMEL [l] cauſed a caſe, or little granary of preſervation, to be made of oak plank two inches thick, forming a cube of five feet every way. At ſix inches from the bottom was a flooring, or ſecond bottom, of lattice work, placed upon joiſts five inches thick, and covered with a ſtrong canvas, in the manner before deſcribed [m]. This ſmall granary was filled quite full of good wheat, of which it contained 94 cubic feet, weighing 5040 pounds. It was covered with good oak planks, ſo cloſely joined, that neither rats, mice, or even the ſmalleſt inſects could get in; leaving only ſome vent-holes, with trap doors, or covers, fitted very exactly to them, as mentioned before [n].

This corn, laid up without having been dried at all by fire, was not ventilated more than ſix days in a year, which was ſufficient to keep it ſo well that the beſt judges allowed it to be as good

l *Traité de la Conſervation des Grains, p.* 26.
m Page 116. n Page 117.

as

as could be. Even when the bellows had not been worked for ſeveral months, the corn was ſtill allowed, by good judges, to look and ſmell perfectly well: but they objected, that it did not handle well, that is, that there was ſome little dampneſs in it. The bellows were worked for half a day, and this objection was entirely removed.

Remark. This wheat was old, and had been as well dried as any corn generally is in a common granary: therefore it being ſtill damp, at the end of a conſiderable time, ſhews the neceſſity of taking away the ſuperfluous moiſture, and of reducing our corn to the ſame degree of dryneſs, as that of the hotteſt countries, in order to preſerve it in great bodies [o].

Experiment on 94 *cubic feet of Wheat.*

In May, 1743, ninety four cubic feet of wheat were put into one of the little granaries before mentioned [p]. It was of the harveſt of 1742, of an excellent quality, perfectly clean, and ſo dry, that a ſmall parcel of it which was put, for a trial, into a ſtove heated to 50 degrees of M. de Réaumur's thermometer (123 of Farenheit's) loſt but one ſixteenth of it's weight. This wheat was well cleanſed from duſt, and depoſited in the granary without being dried by fire.

During the firſt three months, it was ventilated for eight hours once a fortnight: during the reſt of the year 1743, and all 1744, it was ventilated once a month: all the year 1745, and part of 1746, it was ventilated half a day once a month; and after that, but once in two or three months.

[o] DUHAMEL, *ubi ſupra, p.* 53. [p] *Id. ibid. p.* 56.

In

In June 1750, the granary was emptied, and the wheat looked and ſmelt very well, but felt a little rough in the hand, becauſe, not having been ſtirred for ſix years, the little hairs that are at the extremity of the grain, and the particles of the bran, were roughed up: but after paſſing twice through the wind ſcreen *, that objection was entirely removed.

Remark. This corn was eight years old, during ſeven of which it was preſerved in one of M. Duhamel's ſmall granaries, without any ſenſible diminution, and without any damage from vermin or inſects: I cannot ſay abſolutely, without any expence, becauſe a man was employed from time to time to ventilate it. But this was a very trifling charge, and may be reduced almoſt to nothing, by working the bellows with ſwifts like thoſe of a mill.

Experiment on 75 cubic feet of new wheat, extremely moiſt, grown, and which had already contracted a bad ſmell.

The harveſt of 1745 [q] was very rainy: almoſt all the wheat of that year was grown in the ear; the ſheaves were extremely wet when they were houſed; the grains adhered ſo cloſely to their huſks, that they were greatly bruiſed by the flail; and if they were left but a very little while upon the barn-floor, before they were cleanſed, they heated, and contracted a ſmell like that of pigeon's dung: in ſhort, they were ſo very moiſt, that they loſt an eighth part of their weight when dried in a ſtove heated to 50 degrees of M. de Réaumur's

* The ſcreen deſcribed in p. 103, of this volume, or the cylindrical ſieve in p. 119, will anſwer this end equally well.

q *Traité de la Conſervation des Grains, par M.* DUHAMEL, *p.* 63.

(123 of Farenheit's) thermometer; and when laid up in the common granaries, in the uſual way, they were always in a ſtate of fermentation, though but a foot thick, and turned every fourth or fifth day.

Seventy five cubic feet of this grown wheat, which ſmelt very ill, and was ſo moiſt as to wet the floor of the granary where it laid but a few days, were put, in this condition, and without being dried by fire, into one of M. Duhamel's little granaries, with ſmall hopes of ſucceſs.

As this corn was very hot when put into the granary, it was ventilated three or four times the firſt week, and once a week during December and January: and as it had then loſt great part of it's bad ſmell, it was ventilated but once a fortnight from that time till June. Then perceiving, by thruſting his hand into the top of the heap, that it heated, and concluding that it was going to be entirely corrupted, M. Duhamel ordered the granary to be emptied: but after the depth of about a foot had been taken from the top, he was greatly ſurpriſed to find the reſt cool, with very little bad ſmell, and drier than that which was preſerved in the common granaries.

Remarks. The reaſon why the top of this corn was the worſt, was, undoubtedly, that the moiſt vapours were always forced upwards in ventilation. — It therefore might, perhaps, have been kept very well, if, inſtead of emptying the granary, it had been ventilated oftener: for this would, probably, have dried away the remaining moiſture, even at the top, as the following experiment will ſhew. But however that might have been, this teaches us one important thing, which is, that the top of the heap is moſt ſubject to heat in this ſort of granary: ſo that if the grain taken out of the vent-holes is in good

good condition, it may be concluded that the reſt is ſtill better.

Experiment on 555 cubic feet of Wheat, very damp, mixed with ſmut, and which had contracted a bad ſmell.

The wheat of the year 1750 grew in almoſt continual wet; the harveſt was very rainy; and the ſame weather continuing all the year 1751, no pains that could be taken to turn the corn laid up in the common way, could dry it, or prevent it's heating and contracting a bad ſmell. The wheat of this crop was likewiſe mixed with a conſiderable quantity of blighted and ſmutty grains, which always contain a great deal of moiſture, doubly difficult to be exhaled from them, and which ſoon makes them contract a bad ſmell, which they ſpeedily communicate to the ſound corn.

Five hundred and fifty five cubic feet of this wheat were depoſited in one of M. Duhamel's granaries of preſervation, after being cleanſed with ſuch perfect care, that ſcarce any mark remained either of blight or ſmut among it; though theſe faulty grains amounted to near a ſixth part of the crop. But there ſtill remained a fine duſt, or powder, occaſioned by the moiſture, ſo cloſely adherent to the corn, that it could not be taken off by any means.

This wheat was laid $4\frac{1}{2}$ or 5 feet thick in one of theſe granaries, the bellows of which were worked by a wind-will; and as there was no want of wind during all the year 1751, and till the ſpring of 1752, the corn was often ventilated, without trouble or expence; by which means it was not only well dried, but alſo cleared of great part of it's bad ſmell. It was indeed, when taken out of the granary, very full of duſt which had fallen

fallen off the grains as their moiſture was exhaled: but this was then eaſily ſeparated by proper ſcreening, and the wheat proved ſo good, that the bakers bought it at the higheſt market price.

Remarks. This experiment proves, that even very moiſt corn, which has a great diſpoſition to ferment, may be preſerved by ventilation only: and as to the ſmutty grains with which this was mixed, the reverend Dr. Hales, after rightly obſerving that kiln-drying is apt to make wheat grind unkindly, propoſes the following method of drying ſmutty corn, after it has been waſhed; cold air not hurting it, as kiln-drying is found to do. "That I might be well aſſured, ſays that "friend to all mankind, of the good effect of "thus drying ſmutty corn; having procured a "quantity of very ſmutty wheat, which weighed "ſeven pounds and fifteen ounces, on the twenty "ſixth of May, at five in the morning, it was "waſhed clean in four ſeveral waters, which was "done in a few minutes, and was then laid to "drain in an oat-ſieve, till half an hour after five, "when it had increaſed in weight, by wetting, ten "ounces, beſides the moiſture that was equal to "the weight of the ſmut-balls and ſmut that was "waſhed from the wheat. It waſted but two "ounces and an half, by the firſt two hours ven-"tilation; two ounces and five drachms in the "ſecond two hours, *viz.* from eight to ten; in "the next ſix hours, *viz.* from ten to four in the "afternoon, it waſted at the rate of four ounces "every two hours; from four to ſix, two ounces "and an half, and from ſix to eight, one ounce and "an half: in all, about twenty ounces; ſome al-"lowance being made for what corn was waſted by "handling and biting ſome of it from time to time. "It was ventllated in theſe fourteen hours with "about forty thouſand gallons of air, which "paſſed upwards through it, and made it ſuffici-

"ently

"ently hard and dry, ſo as to be fit for grinding: "it was well coloured, and handled well; and, "from ſtinking, as ſmutty wheat does, it be-"came much ſweeter. The viſible dewy moiſture "was blown off in three hours; but it continued "damp and cold to the feeling till two o'clock, "when ſome little duſt began to fly off it.

"And whereas it waſted off much leſs moiſture "during the firſt four hours ventilation, when it "ought to have waſted the moſt, on account of "it's being then wetteſt, this was owing to the "foggy hazineſs of the morning: which as it "went off, and broke out into fine warm ſun-"ſhine, towards ten o'clock, ſo the air being "thereby become dry, it imbibed moiſture more "ſtrongly from the corn: and that this was the "true caſe of the difference, is farther confirmed "by a like experiment which I had before made "on a gallon of wheat, April the firſt, there be-"ing then a very dry north-eaſt wind.

"It will be adviſable to begin to ventilate corn "as ſoon as poſſible after waſhing, that the moiſ-"ture may have the leſs time to ſoak in: for the "leſs the moiſture ſoaks in, ſo much the ſooner "the corn will dry.

"If the moiſture is ſo eaſily carried off from "wet wheat, by ventilation, this method will "doubtleſs much improve what is called cold "wheat, *viz.* ſuch as is grown, and has been "houſed in a cold wet ſeaſon; and will therefore "ſoon carry off the moiſt vapours which ariſe from "corn, and which cauſe it to heat and grow muſty."

Other Experiments on the preſervation of Corn by Ventilation only.

The prior of the royal abbey of St. Stephen in Caen filled a granary of preſervation 12 feet wide, 13 feet long, and ſix feet deep, which forms a

parallelipipede of 936 cubic feet, conſtructed according to M. Duhamel's directions, with wheat that had been kept all the winter in common granary. It was cooled from time to time by two bellows, which two men worked by means of a lever; and though the place where this granary of preſervation ſtood, was neither ſo dry nor ſo airy as might have been wiſhed, the corn kept perfectly well in it[r].

In the beginning of September 1754, M. Vandusfel filled one of M. Duhamel's granaries of preſervation, ſeven feet ſquare and ſix feet deep, with good wheat, undried. It heated a little at the end of eight days; but two men, with a ſmall double ventilator, cooled it in two hours time. It began to heat again about a week after, when he repeated the ſame operation, which cooled it preſently. By the 20th of October it was quite cool, though it had not then been ventilated for fifteen days; and according to a letter of his writing to M. Duhamel, dated the 14th of October 1756, it ſtill continued in the ſame good condition. Corn of the years 1754 and 1755, not dried, but only ventilated, had likewiſe kept with him as well as could be wiſhed[s].

M. Duhamel filled one of his little granaries with oats, and another with barley; to try whether theſe grains may not be preſerved as well as wheat, by ventilation only[t].

The oats remained cool, and kept extremely well: but the barley emitted ſo great a quantity of moiſture, that the boards at the bottom of the granary were quite warped by it; and this grain heated to ſuch a degree, that the bellows worked by hand could not cool it, though conſtantly plied for eighteen months together. When this granary

[r] DUHAMEL, *Traité de la Culture des Terres, Tom.* V. *p.* 308. [s] *Ibid. p.* 310. [t] *Ibid. p.* 302.

was

was emptied, it's inſide was found to be covered with a ſtinking glutinous moiſture, which had communicated itſelf to the whole maſs of this corn. M. Duhamel then judged that all of it was ſpoiled; eſpecially as the heat had ſpread to every part of the granary, and the outſide of the corn was rotted all over near two inches deep, and ſtuck to the ſides and bottom of the granary. He likewiſe perceived that a prodigious number of weevils had bred in this barley. However, reſolving to try whether he could not yet make ſomething of this corn, he ordered it to be put into his ſtove, and then to be ſifted and winnowed, to clear it of the grains that had no flower in them, which were pretty numerous. This operation leſſened the maſs by about one twelfth: but the good grain was rendered very dry, and had no bad ſmell.

EXPERIMENTS ON THE PRESERVATION OF CORN BY STOVE-DRYING * ONLY.

WHEN the corn is too moiſt to be laid up in the granary of preſervation, M. Duhamel propoſes two methods of preparing it for that purpoſe [t].

The firſt is, to keep it near a twelve month in a common granary, during which there will be ſufficient opportunities to uſe all means of cleanſing it; and by theſe operations it will loſe ſo much of it's moiſture, as to be perfectly fit for the ventilating granary.

* It is to be remembered, that a kiln, or an oven, will do equally well in this country, eſpecially for ſmall, or middling quantities of corn; though I uſe M. Duhamel's expreſſion, *Stove-drying*, becauſe I am giving his experiments.

[t] *Traité de la Conſervation des Grains, p.* 74 *and* 76.

Remark. This will anſwer for ſuch as deſire to preſerve the produce of their own lands only, and are already provided with a good common granary: but thoſe that would buy a large quantity of corn, when the price is very low, for the chance of ſelling it at a better market, muſt follow his

Second method, which is, to dry it in a ſtove (an oven or a kiln may do equally well) as ſoon as it has been thoroughly cleaned, and then to paſs it through a wind-ſcreen, to cool it, and cleanſe it from duſt. After this, it may be put into the granary of preſervation without fear, as will appear by the following experiments.

Experiment on 90 cubic feet of fine wheat dried in a ſtove, and preſerved without ventilation[u].

This wheat, though very full of ſmut and duſt when it was reaped and threſhed, was ſo well cleanſed as to have no fault remaining but dampneſs. It was dried in a ſtove, by which it loſt a little diſagreeable ſmell it had before; and when it was thought to be ſufficiently dry, it was laid up in one of M. Duhamel's granaries of preſervation, which had bellows adapted to it: but there was no occaſion to uſe them; for the corn kept extremely well without ever being ventilated.

Remark. This experiment ſhews, that wheat well cleaned and dried need not be ventilated.

Experiment on 75 cubic feet of ſmall wheat mixed with ſmut, preſerved by ſtove-drying only, without ventilation.

"Our different ſcreens, ſays M. Duhamel[x] ſeparated the fine large wheat from the ſmall, and

[u] *Ibid. p.* 77. [x] *Ibid. p.* 79.

cleanſed

cleanſed the former perfectly: but all our care could not free this ſmall grain from ſmut, duſt, &c. of which much remained among it; nor did the ſtove clear it from the bad ſmell it had contracted.

"Frequent ventilation would undoubtedly have taken away that bad ſmell, or at leaſt have prevented it's increaſing: but as the deſign of this experiment was to try the effect of the ſtove only, we determined not to ventilate, unleſs there ſhould be great danger of the wheat's corrupting; which did not happen. However, the bad ſmell increaſed ſo much, that we were obliged to ſtove-dry it again after it was taken out of the granary of preſervation, and to ſcreen it ſeveral times. With theſe precautions, it made pretty good bread.

"*Remark.* This experiment ſhews, firſt, how neceſſary it is to clean the corn well before it is put into the granary of preſervation; and that both ventilation and ſtove-drying are requiſite in ſome caſes: and ſecondly, that corn which has contracted a bad ſmell, may be cleared of it by the ſtove and the wind-ſcreen.

Wheat which had begun to grow, and had contracted a bad ſmell and taſte, preſerved by ſtove-drying only[y].

A parcel of wheat of the growth of 1755, which was a very wet year, had begun to grow, and had contracted a very bad ſmell and taſte. It dried perfectly in the ſtove, came out in excellent condition for keeping, and had loſt it's offenſive ſmell: but if it was chewed, it ſtill had a diſagreeable taſte. The dough made of the flour of this grown corn, which ſeemed to have been ſo well recover-

[y] *Traité de la Culture des Terres, Tom.* V. *p.* 299.

ed, did not riſe in the kneeding-trough, and the bread made of it was very heavy, and of a diſagreeable flavour.

After thus ſhewing that good wheat, well cleanſed, and properly dried in a ſtove, may be preſerved without ventilation; and that ſuch corn, tolerably dry, may be preſerved by ventilation only; M. Duhamel rightly concludes, that it muſt be moſt advantageous to join both methods, eſpecially for large magazines; and as a proof thereof, he gives us the following

EXPERIMENTS ON THE PRESERVATION OF CORN BY STOVE-DRYING AND VENTILATION.

EIGHT hundred and twenty five cubic feet of large grained wheat, of the growth of the year 1750, which was of but a middling quality, were put into one of his granaries of preſervation, after having been well cleaned, and ſlightly dried in a ſtove. The bellows of this granary were worked by ſwifts like a wind-mill.

This corn had a bad ſmell, which was not entirely diſſipated by the ſtove, but was quite carried off by careful ventilation. It not only kept extremely well, but was even meliorated, and became of ſo good a quality, that the bakers preferred it to all other, and gave ten pence a ſack more for it, than for the ſame wheat preſerved in the common way [z].

M. Duhamel had a parcel of wheat of the year 1755, which, having been reaped in rainy weather, continued extremely damp: and though care had been taken to turn it every week, from the time of it's being removed out of the barn, it had contracted a very bad ſmell, not unlike that of pigeon's

[z] *Traité de la Conſervation, des Grains, p.* 81.

dung.

dung. This determined him to ſtove-dry it for forty eight hours. He did ſo in May 1756, and it was thereby cleared of that putrid ſcent. He then ordered it to be ſifted immediately, to cool it, and cleanſe it from the ſmall duſt which falls off dry corn, and then to be laid up, and frequently ventilated, in one of his granaries of preſervation. His directions were followed, and this wheat remained perfectly cool, ſweet, and ſound [a].

Remark. We ſee by theſe two experiments, that either ventilation or ſtove-drying will remove the putrid ſmell of corn; and we have in this laſt a remarkable inſtance of the good effects of the ſtove, ſince it rendered capable of being preſerved, wheat which could not have been kept in the common way.

It is, however, to be obſerved, that both dried and undried corn will contract a diſagreeable ſmell, if ſuffered to remain a month without being ventilated. This ſmell is perceived moſt when the bellows firſt begin to work; but it then is diſſipated in a few minutes. It is not a ſymptom of corruption or decay, but only a ſtrong ſmell of corn; ſuch as is always perceived on entering into a granary that has been ſhut for any length of time.

Great as our obligations to M. Duhamel are in very many reſpects, they do not end here, even in this. Indefatigably ſtudious to be of real ſervice to mankind, and too intelligent not to ſee at once the extent of his judicious experiments; it cannot be ſuppoſed that one of the greateſt obſtacles to the keeping of corn, which is the inſects that breed in it, could eſcape his attention. Of theſe, the moſt univerſally formidable are the falſe moth and

[a] *Traité de la Culture des Terres, Tom.* V. *p.* 299.

the weevil *: and he accordingly ſpeaks of them in all his writings upon agriculture, where he at the ſame time relates various trials made to deſtroy them, and points out the means hitherto found beſt to anſwer that deſirable end.

Of the falſe Moth, *or* Corn-worm; *with the means of deſtroying it.*

TO the deſcription before given † of this pernicious inſect, and of it's manner of preying upon corn, little need be added here, except the experiments by which it has been deſtroyed.

In it's ſtate of moth, it is grey, has ſix legs, and is frequently ſeen in vaſt numbers fluttering about the eaves and windows of granaries, in the ſpring and ſummer, when the weather is very hot. The females lay their eggs upon the heaps of wheat, and theſe eggs produce the caterpillars, or corn worms as ſome call them, which feed on the grain, and envelop it with their ſilky web, ſo as to form over the whole ſurface a cruſt that is ſometimes three or four inches thick. This entirely ſpoils the corn within that depth, beſides communicating a bad ſmell to all the reſt. Theſe worms, or rather caterpillars, for they have ſixteen legs, are ſmooth, whitiſh, and ſeldom exceed a quarter, or at moſt the third part of an inch when at their full growth. Breaking of their webs avails but little, for they are woven again by the next day: for which reaſon ſome have been of opinion, that it is beſt to let them enjoy undiſturbed the ſurface

* I do not here mention the corn caterpillar, becauſe it is a local ſcourge, peculiar to the province of Angoumois, and has been already treated of very fully. See *p.* 45 — 91 *of this Volume.*

† See *page* 53.

of

of the corn of which they have taken poſſeſſion. But it ſhould be conſidered, that three inches are a ſixth part, and four inches upwards of a fifth, of any quantity of corn ſpread eighteen inches deep, which is the medium thickneſs at which it is laid; and that, independant of the bad ſmell with which the reſt is tainted, this is a very conſiderable object, though it extend no farther[d]. When this cruſt is broken, moſt of the grains which compoſe it are found to be either gnawn in their inſide, or full of live worms, or of aureliæ, according to the ſeaſon; or one ſees only the empty ſheaths of the caterpillars, if the aureliæ have been transformed into moths.

It is ſaid, that ſtrewing the corn with powdered lime, ſo as to form a cruſt over it, will preſerve it from the ravages of theſe inſects: but as the ſurface would ſtill be ſpoiled, and as that ſurface may be a conſiderable part of the ſmall proviſion of wheat allotted for a family only, M. Duhamel did not try this expedient[e]. Covering it with hay, which he did try, anſwered no end whatever[f].

Theſe obſervations, and the reflections conſequent thereon, made him ſuſpect that this inſect, as it delights in none but very warm places, would not be able to live in the cold air of his ventilating granaries.

Accordingly, in the winter of the year 1746, he collected all the wormy cruſts which theſe caterpillars had formed in his common granaries, where they were very thick, the moths having been extremely numerous the preceding ſummer. Theſe cruſts were broken and ſcreened; and what

d DUHAMEL, *Traité de la Conſervation des Grains*, *p.* 87. and *Eléments d'Agriculture*, *Tom.* I. *p.* 419.

e *Eléments d'Agriculture*, *Tom.* I. *Liv.* 5. *c.* 2. f *Ibid. p.* 19.

grain

grain could be got from them, which undoubtedly was impregnated withthe eggs of the moths, was put into one of his granaries of preſervation, which contained ſeventy five cubic feet, and was ventilated from time to time during all the winter.

Towards the end of May, when the vent-holes at the top of this granary were opened, a prodigious number of moths flew out; which ſhewed that they did not like their ſituation.

When the wheat was thought to have been ventilated ſufficiently, the holes were ſhut cloſe, and nothing more was done to it for a month: for as this corn (which had not been ſtove-dried) was old and dry enough, it was but ſeldom ventilated.

In June 1747, this granary was emptied: all the moths and worms were dead, and there remained only a thin cruſt, not above a twelfth part of an inch thick, on the top of the corn, which had ſo far loſt the bad ſmell it had when put it into the granary, that it ſold for the current market price [g].

Not ſatisfied with this ſingle method, M. Duhamel tried the effect of the ſtove upon another parcel of wheat known to be full of theſe worms. A heat from 45 to 50 degrees of Réaumur's thermometer (from 115 to 124 of Farenheit's) killed them all. This corn was then laid up in a common granary, where it remained two years without being attacked by any of theſe moths; and even in the third, but very few of them appeared [h].

Theſe experiments remove all doubt of the poſſibility of deſtroying the corn-moth, or worm, without hurting the grain, which would otherwiſe be ſpoiled by it: and as that grain generally is

g *Traité de la Conſervation des Grains, p.* 88.

h *Elémens d'Agriculture, Tom.* I. *Liv.* 5. *c.* 2.

wheat

wheat (for this inſect always prefers it to any other), this diſcovery is of very great importance to the huſbandman, and to the public.

The weevil, of which I am next to ſpeak, is much more difficult to conquer.

Of the Weevil, *and the means of deſtroying it.*

THIS inſect is of the beetle kind, reſembling a ſmall May-bug, with a long ſharp pointed head, to the hinder part of which are fixed two *antennæ*[i]. It is black, and therefore eaſily diſtinguiſhed in any corn: but it's principal and favourite food is wheat, of which, either old or new, it devours great quantities; without, however, communicating any bad ſmell to it, as the moth does. Some call it the *corn-louſe*, becauſe it bites animals more ſtrongly than fleas do. This has made it to be looked upon as a carnivorous inſect; and many have pretended that it devours both the worm and the chryſalis of the falſe moth: an opinion which M. Duhamel does not think improbable, becauſe, in effect, very few of thoſe moths are ever found in corn where there are many weevils.

Upon thruſting one's hand into a heap of corn, one may eaſily perceive, by it's heat, whether it contains many of theſe inſects, which generally lie pretty much collected; and the particular places where they are moſt numerous, feel much warmer than the reſt. This obſervation ſoon led M. Duhamel to think, that a conſiderable heat is probably neceſſary for the hatching of their eggs; and that, in this caſe, even if they ſhould live, they will not be able to breed, in his ventilating granaries.

[i] *Ibid. p.* 414.

To

To aſcertain this fact, he put ſome weevils into wheat (not ſtove-dried) in one of thoſe granaries, in May 1751. It was well ventilated from time to time, and opened in Auguſt 1752, when none of them were found [g]. He did the ſame with wheat which had been ſtove-dried; and when the granary was emptied, a year and half or two years after, not a weevil could be ſeen [h].

He again put ſome weevils into a ventilating granary in which wheat of the year 1754 was laid up, without having been ſtove dried. This corn was taken out in May 1756, and ſifted over a fine ſcreen; which gave him an opportunity to obſerve whether the weevils had increaſed. Their number ſeemed to him nearly the ſame as that he had put in: and a farther reaſon which induced him to think they had not multiplied, was, that this grain, inſtead of being heated, as corn is well known to be whenever weevils breed in it, was ſo cool, that a country fellow employed for this work could hardly remain bare-footed among it [i].

In 1755, Dom Edward Provenchere, procurator of the Carthuſians of Liget, near Loches, in the province of Touraine, intending to make ſome experiments on the preſervation of corn, choſe for that purpoſe a large caſk, at one end of which a little above the common bottom, he put a floor of lattice work, and over that a canvas. This caſk was filled with wheat of the harveſt of 1754, of which it contained 1080 pounds. He then fixed to it a pair of middle ſized bellows, ſo ſituated that they might eaſily be worked; and nearly in the centre of this corn, he put as many weevils

[g] *Traité de la Culture, des Terres, Tom.* V. *p.* 298. and *Traité de la Conſervation des Grains, p.* 97.

[h] *Culture des Terres, Tom.* V. *p.* 299.

[i] *Ibid. Tom.* V. *p.* 298.

as

as weighed ſix drachms; which is pretty conſiderable for that quantity of grain.

The bellows were blown an hour every week. In the beginning of September 1756, when that operation had been neglected for ſome time, the corn began to heat: but it was ſoon cooled again by uſing the bellows. The 15th of October, on taking the corn out of this caſk, in which it had kept perfectly well, not above twenty weevils were found in it. Dom Edward ſays he ſaw that inſect come out of the vent-holes every time the bellows were blown. He perceived in many places ſeveral grains of corn linked together by threads, certainly formed by moths that were in his wheat (which had not been ſtove-dried), and, not dying immediately, had had time to ſpin their web*.

Dom Edward filled another caſk with 900 pounds of barley, not ſtove-dried, and put into it ſix drachms of weevils. Though care was taken to ventilate this caſk as much as the former which was filled with wheat, that is to ſay, during an hour every week, yet this corn heated prodigiouſly: the bellows could not cool it, and the weevils multiplied in it exceedingly.

"This, ſays M. Duhamel [k], is the very thing "that happened to me in my larger experiment "on the ſame kind of grain †. Barley probably "contains a great deal of moiſture; and the "queſtion is whether ſtove-drying can be able to "preſerve it. The increaſe of the weevils here "ſeems to prove, that this inſect cannot multiply

* M. Duhamel wiſhes here for as ſtrong proofs that the weevil cannot live in his ventilating granaries, as he has had that the moth cannot. *Traité de la Culture des Terres, Tom.V. p.* 306.

k *Ubi ſupra, p.* 307.

† See *p.* 130.

"in

"in corn which retains a proper degree of cool-"neſs."

Though the above experiments ſeem to prove pretty clearly, at leaſt that the weevil cannot breed in corn which is kept properly cool, and that if any ſure way to deſtroy this inſect be ever diſcovered, it will be moſt likely to ſucceed by means of the ventilating granary; yet M. Duhamel, with his conſtant candour and unvaried zeal for the welfare of mankind, exhorts the naturaliſt, the philoſopher, the lover of the public good, not to rely too much on any thing that he has ſaid in this reſpect; to look upon the trials which he has related, as ſteps only which may help to lead to that deſired end; and to continue their endeavours to render to the world the important ſervice of ſhewing how this creature may be effectually exterminated, by any ſafe and practicable method.

"I have tried, continues he, in his lateſt writings upon agriculture [1]," many of the receipts moſt vaunted in books of huſbandry, as remedies againſt the weevil, and have not found the leaſt benefit from any one of them. All that they have taught me, is that this animal will endure a great deal before it can be killed. It will live a long time without eating: cold will benumb it ſo as to make it appear to be dead; but I have put ſome of them, in that ſtate, into a warm place, and after keeping them there for ſome time, have found that they were perfectly alive: the great coolneſs of my granaries has ſeemed to prevent their increaſe; but it has not killed them. They bear eaſily a heat of from 45 to 50 degrees of Réaumur's thermometer (from 115 to 124 of Farenheit's). I kept corn in which there were many weevils, during half an hour, in a place heated to upwards

[1] *Eléments d'Agriculture, Liv.* V. *c.* 2. Art. 1.

of

of 80 degrees of Réaumur's thermometer (210 of Farenheit's): ſome of them periſhed; but others remained alive. They, therefore, who would deſtroy them by ſuch a degree of heat, muſt let their corn be expoſed to it during ſeven or eight hours at leaſt *.

"I grant that the ſmoke of ſulphur will kill any inſect; but that method is not practicable in granaries: for this vapour, which is very light, aſcends to the top of the granary, and ſcarcely acts at all upon the corn on the floor. It is true, that the corn may be ſo diſpoſed as to let this ſmoke paſs through it, and all the inſects in it will then be deſtroyed. But, at the ſame time, this ſmoke will give the corn a very diſagreeable and laſting ſmell, which depreciates it entirely. Conſequently this method will not do.

"It is confidently ſaid, that the weevils may be driven away by turning the corn with ſhovels rubbed with eſſence of turpentine. To try whether this eſſence really diſpleaſes them, I ordered two large caſes to be made: the inſide of one of them was rubbed with eſſence of turpentine; both of them were filled with corn in which there were many weevils; and the inſects remained as quiet in the one as in the other. It is true, that when corn infeſted with weevils is turned with a ſhovel, ſeveral of thoſe inſects quit the heap, and haſten towards the walls of the granary. This may have been imputed to the rubbing of the ſhovel with

* A ſtill longer continuance of heat will therefore account for their being killed, in M. de Cers's experiments (p. 86. and 87), in one caſe by 42½ degrees of heat according to M. de Réaumur's thermometer (110 of Farenheit's); and in the other, by a heat which raiſed the former to only 40 degrees, which are equivalent to but 105 of the latter. Theſe experiments were, indeed, made in an oven: and how far that may have contributed to ſtifle the weevils, more than a ſtove might do, I cannot pretend to ſay.

oil of ſpikenard or eſſence of turpentine: but the ſame thing happens when the ſhovel has not been rubbed with any drug whatever; and the fugitive weevils ſoon return to the heap of corn.

"When corn is ſifted in a ſieve (and the ſame is applicable to a ſcreen) fine enough to retain the grain; the weevils, then agitated, ſhrink up their legs, and are, in that poſture, generally ſo much ſmaller than the good corn, that very many of them drop through the ſieve. The greateſt part of them may therefore be deſtroyed by this method, which is a very good one: but, unfortunately, there will ſtill remain enough of them among the corn, to do conſiderable damage. This ſieve or ſcreen, ſhould be of wire; and under it ſhould be placed an earthen or copper veſſel, pretty deep, to receive the inſects, and ſmooth on it's inſide, to prevent their getting out eaſily.

"Of all the methods I have tried, that which has ſeemed to me to be the beſt, is to dry the corn in a ſtove, or oven, heated to 80 or 90 degrees of M. de Réaumur's thermometer (from 210 to 230 of Fahrenheit's) and to let it remain there twelve hours. I exhort all thoſe who wiſh the welfare of the public, to ſtudy the means of deſtroying the weevil, and, in conſequence thereof, to make particular experiments: but I beſeech them not to publiſh their diſcoveries till they have made repeated trials of them, and that in different granaries: for I have ſometimes ſeen theſe inſects forſake a granary, when no cauſe could poſſibly be aſſigned for their ſo doing."

M. Duhamel, extending his views to every object of public utility, ſpeaks thus

Of the Preſervation of Corn in Ships[m].

"The greateſt care cannot always guard againſt the wants of a nation whoſe harveſts are

[m] *Conſervation des Grains*, c. ix.

uncertain

uncertain, or whoſe crops have failed; ſo far as to prevent it's being ſometimes obliged to have recourſe to other countries. Corn is then conveyed thither in ſhips, of which there are few that do not let in ſome water, the moiſt vapours of which, eſpecially when it is corrupted and ſtinks, as it often does very violently, diffuſe themſelves throughout the hold of the veſſel, where alone the grain can be ſtowed. Theſe putrid exhalations, joined to thoſe of the ſalted proviſions, cheeſe, &c. ſtored in the ſame place, communicate a bad ſmell to the corn; while the cloſe heated, and damp air in the hold diſpoſes it ſtrongly to ferment. In this ſituation, wheat in particular, which is the moſt ſuſceptible of theſe impreſſions, has frequently been irretrievably damaged. The moiſture has ſwelled it, the heat has made it grow, and the bad ſmell has utterly ſpoiled it's quality.

"The Dutch, to preſerve the corn which they ſend by ſea, dry ſome of it very much, and even parch a part of it in ovens; after which they mix this with the reſt, to abſorb the moiſture of the whole maſs. But this method, though it diminiſhes the evil a little, does not preſerve the corn totally from the injuries before mentioned; and the parching of the grains hurts the quality of the bread. I therefore prefer the following method.

"Let caſes, or granaries of preſervation, like thoſe before deſcribed (*Plate II. Fig.* 4. and 5, and page 116), be cloſely caulked along all their ſeams, and well paid over their whole outſide, to prevent the entrance of any moiſture, and let the corn deſigned for ſhipping be depoſited in them, after it has been thoroughly dried in a ſtove. The vent-holes here muſt be doubly ſecured with cloſe netted wire, to guard againſt rats, which are

extremely formidable in ſhips *. One large pair of bellows placed between deck, will be ſufficient to ventilate all the caſes in the hold, or any one of them ſingly, by means of a leathern pipe, or pipes, which will convey the wind down to it, or them. In general, if they are ventilated one after another during the voyage, the bellows ſhould be worked every day, an hour and a half in the morning, and the ſame in the evening. When the corn is landed, it ſhould be ſtove-dried again, to carry of what moiſture and bad ſmell it may have contracted in the hold of the ſhip. By this means the grain will certainly be well preſerved, in good condition, and fit for laying up in common granaries, or in granaries of preſervation, if it be intended for long keeping. The expence attending this method will not, upon an average, be found to exceed, if it equals, the damages and hazards to which corn is expoſed when it is ſhipped in the uſual way. This may likewiſe be applied to the carriage of corn upon rivers, where the current of the ſtream may, perhaps, be made to work the bellows."

* Though I cannot warrant the efficacy of either of the following receipts for killing rats, from any experience or certain knowledge of my own; yet they are ſo ſtrongly recommended, as infalliable for that purpoſe, that I ought not to omit mentioning them here.

The firſt has the ſanction of the Dublin ſociety, who on the 19th of November 1762, ordered a premium of five guineas to one Laurence O'Hara, for this diſcovery; which is "One "quart of oat-meal, four drops of Rhodium, one grain of "Muſk, and two nuts of Nux vomica finely raſped." This mixture is to be made up in pellets, and laid in the holes and places which the rats frequent.

The other receipt is thus: "Take of the ſeeds of ſtaves-"acre, or louſe-worth, powdered, one fourth part, and of oat-"meal three parts; mix them well and make them up into a "paſte with honey. Lay pieces of it in the holes, and on the "places frequented by rats or mice, and it will kill ſuch of "thoſe vermin as eat thereof." *Gent. Mag. March* 1763.

PRAC-

PRACTICAL HUSBANDRY.

PART III.

OF PASTURES.

HAVING now given the beſt account that my utmoſt care and attention could enable me to collect, of the culture and management of all the various kinds of grain and pulſe, in their ſeveral ſtates; I proceed to treat of paſtures, a ſubject of great importance to the farmer, and to the public. This is by much the leaſt expenſive, but by no means the leaſt profitable, part of Agriculture; and therefore claims the huſbandman's ſpecial attention.

The judicious Cato, being aſked, as Pliny tells us [a], which is the ſureſt way of getting money, anſwered, "Providing plenty of food for cattle:" and being farther aſked, which is the next beſt way, he replied, "Providing leſs plenty of food for "cattle." In effect, cattle, which may be ſaid to be the ultimate produce of paſtures, are always a ready marketable commodity, and of eaſy tranſport. To this nation, in particular, paſtures are the baſis of un-rivalled proſperity, the ſource from whence our golden fleece ariſes, and the means of victualling thoſe floating caſtles which carry the Britiſh glory, and commerce, from pole to pole.

In proſecuting my taſk hitherto, the ſubject has ſwelled much beyond my firſt intention; becauſe I have choſen, upon mature deliberation, and in

[a] Cato interrogatus, quis eſſet certiſſimus quæſtus, reſpondit, ſi bene paſcas. Quis proximus? Si mediocriter paſcas. *Natural Hiſt. Lib.* XVIII. *c.* 5.

conſequence of the advice of very competent judges, rather to leave nothing unſaid, which may be of ſervice to mankind in their rural concerns, than wilfully to maim my performance, by confining it, right or wrong, to preciſely fixed dimenſions. Such ſhackles, deviſed by certain venders of books, who would ſubject the whole circle of ſciences to the mechanical ſtandard of ſizes ſuited to their ſhops, are inconſiſtent with a writer's duty to the public, and with what he owes to himſelf, if he values his reputation. I do not, however, here mean to beſpeak for myſelf an unbounded latitude in favour of this Syſtem of Agriculture. On the contrary, I promiſe, that, though I ſhall endeavour not to omit any material inſtruction, it ſhall not exceed the limits really neceſſary for the many important objects which intereſt the husbandman, and conſequently the whole world, and of which I have engaged to treat. In ſhort, my ſtudy ſhall be, to render it as generally uſeful, and as little expenſive, as I poſſibly can.

As the firſt volume of this work contains ample inſtructions for the farmer thoroughly to prepare his land; I ſhall now ſuppoſe it to be in perfect tilth, and conſequently fit for the production of all ſuch plants as are uſed for the food of cattle. Here I ſhall begin with thoſe that are intermixed, or interchanged, with crops of corn: I ſhall then proceed to ſuch as are of longer duration, but require frequent help; and I ſhall end with paſtures laid down with common graſs.

In treating of this ſubject, I ſhall extend the meaning of the word *Paſture* much beyond the uſual acceptation, by including under it, as Pliny has done [b], every ſubſtance given as food to cattle.

[b] *Ubi ſupra, c.* 2.

CHAP.

CHAP. I.

Of ſuch Plants as are uſually intermixed with Crops of Corn, or which may be cultivated interchangeably with Corn or Pulſe.

I Shall divide theſe into three claſſes; viz.

1, Thoſe of which the roots are the principal part uſed for paſture; ſuch as turneps, carrots, parſneps, parſley, potatoes, &c.

2, Thoſe whoſe leaves and ſeeds are uſed for paſture; ſuch as cabbage, cole, rape, &c. and

3, Thoſe which are properly called graſs; as clover, rye-graſs, perennial vetches, &c.

SECT. I.

Of Plants whoſe Roots are the principal part uſed for the food of cattle.

ART. I.

OF TURNEPS.

IT is Pliny's opinion [c], that if due order were obſerved, turneps ought to be eſteemed next to corn, or at leaſt next to beans; for that, after them nothing is of greater uſe. They grow, ſays, he, for all animals: four-footed beaſts delight in their leaves; men are as well pleaſed with their tender ſhoots, in their proper ſeaſon, as with ſprouts; and their roots are ſo great a relief when there is a ſcarcity of corn, that they are capable of preventing a famine *. Mr.

[c] *Ibid. c.* 13.

* The Philoſophical Tranſactions relate (No. 90), that in the years 1629 and 1630, when there was a dearth in England,

Mr. Miller is therefore juſtly ſurpriſed [a] that ſo great an improvement as the ſowing of turneps in fields, for feeding cattle, ſhould have been ſo long neglected as it was in every part of Europe; ſince it is very plain that this huſbandry was known to the ancients: for Columella, likewiſe, in treating of the ſeveral kinds of vegetables which are proper for the field, recommends [b] particularly the cultivating of good ſtore of turneps, becauſe ſuch of them as are not wanted for the table, will be eaten by cattle.* Yet it is not many years ſince the raiſing of this plant for the food of cattle has been in general uſe; nor is the right method of cultivating turneps yet ſufficiently known, or at leaſt it is not practiſed, in

[a] *Gardener's Dict.* Art. RAPA: [b] *Lib.* II. *c.* 10.

very good, white, laſting, and wholeſome, bread was made of boiled turneps mixed with a ſmall quantity of meal. They fermented well, and kneeded kindly together. And again (No. 205), that the dearneſs of all ſorts of corn in the year 1693, occaſioned many poor people in Eſſex to make bread of turneps. Their way of making it was to peel the turneps, and boil them in water till they were ſoft and tender: then, after ſtrongly preſſing out the juice, they mixed them with an equal weight of wheat meal, added a proper quantity of ſalt and yeaſt, and, with warm water, kneeded this up like other dough or paſte. They then let it lie a little while to ferment, and afterwards baked it as common bread. This turnep bread, continues my above authority, is not to be diſtinguiſhed, by the eye, from common wheaten or houſhold-bread; neither doth the ſcent much betray it, eſpecially when cold; only to dainty and nice palates, the turneps are a little, and but a little, perceived.

* Mr. Miller might, and I think he ſhould, have added to this quotation, Columella's ſaying very expreſsly, that turneps are the firſt of vegetables next to corn; and that they were greatly eſteemed and cultivated for the food of cattle, even in his time, particularly in Gaul, where beaſts were fed chiefly with this root in the winter. Columella's directions for cultivating turneps are nearly the ſame as the very beſt methods that are followed now; which ſhews to what height the ancient Romans had carried their knowledge in Agriculture. See L. I, M. COLLUMELLÆ, *de Re ruſtica, Lib.* II.

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ſome of the diſtant counties of England: for in many places the ſeed is ſown with barley in the ſpring, and thoſe turneps which come up, and live till that corn is cut, produce a little green for ſheep to pick up, but never have any roots: and in others where the turnep-ſeed is ſown by itſelf, the method of hoeing the plants is not underſtood; ſo that weeds and turneps are permitted to grow together, and where the turneps come up thick in patches, they are never thinned; through which neglect they draw up to have long leaves, but never have good roots, which is the principal part of the plant, and therefore ſhould be chiefly attended to.

The ſorts of turneps moſt profitably cultivated for the food of cattle, which is our only object here, are the red or purple topped, and the large green topped turneps. The roots of both of theſe, which are only varieties of the ſame ſort †, will grow to a large ſize; but thoſe of the latter continue longeſt good: for which reaſon this is generally, and rightly, preferred. The red or purple topped turnep is alſo extremely good for ſome time; but its roots become ſtringy much ſooner than thoſe of the green topped: for which reaſon it is not now ſo much cultivated as it was formerly. The long rooted turnep, the yellow turnep, and the blackiſh rooted turnep, are now rarely cultivated in England; neither of them being ſo good either for the table, or to feed cattle, as the red and the green topped turnep. The Dutch turneps, and the French, are well taſted while they are young; but they become rank and ſtringy when ſuffered to grow to their full ſize, which is not large: conſequently theſe are not fit for cattle.

† Namely, of the *Rapa radice orbiculatâ depreſſâ carnoſâ*; which is C. Bauhin's *Rapa ſativa rotunda, radice candidâ.*

The green topped turneps, which are the ſofteſt and ſweeteſt taſted, grow more above ground than any other ſort of this plant; and therefore are, beſides being the beſt in all other reſpects, the moſt convenient for the feeding of cattle. Their long tap root ſupplies them with ſufficient nouriſhment. But this ſituation renders them very liable to be hurt by froſt, in ſevere winters, eſpecially if they are not covered with ſnow: for alternate hard froſts and thaws will make theſe rot ſooner, than thoſe whoſe fleſh is leſs tender. M. Duhamel has had turneps of this ſort upwards of nine inches in diameter, and which weighed above twenty pounds[c]; and Mr. Miller has ſeen ſome of them boiled, of more than a foot in diameter, which were as ſweet and tender as any of the ſmalleſt roots[d].

Turneps thrive beſt in a light, ſandy, loamy, and deep ſoil‡. If it be moiſt, they will grow the

c *Elémens d'Agriculture, Tom.* II. *Liv.* 9. *c.* 4.

d *Gardener's Dict.* Art. RAPA.

† The Society of Improvers in the knowledge of Agriculture in Scotland obſerve[a], that, "though it be generally "thought that the natural ſoil for turneps is a light ſandy "ground; yet there ſeems to be no reaſon to found exceptions againſt other ſoils, provided they be cultivated as they "ought: for, by an experiment mentioned in the Tranſactions "of the Royal Society (No. 360), it has been found, that on "moſs or peat-ground, turneps have by growth increaſed "15,990 times the weight of their ſeeds each day they ſtood "upon it.— It is true that ſmall ſeeds eſpecially thrive beſt "in a fine mould; and as light ſoils are moſt eaſily made "fine, they are thought to be the beſt for them. But why, "add thoſe gentlemen, may not clay be made fine enough by "the plough, harrow, and roller?—The plowing for turneps "and all tap-rooted plants ſhould be as deep as poſſible, that "their roots may the more eaſily deſcend. Indeed if deep "plowing is neglected, turneps may well thrive better on

a *Maxwell's Collection of Miſcellaneous papers on Huſbandry*, p. 20 and 21.

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the better in ſummer, eſpecially in freſh land, where they are always ſweeter than upon an old worn-out ſoil. For them to grow very large, the ground muſt have been well prepared and well manured ſome time before ſowing: for dung laid on then would breed inſects, which would damage the roots, and kill the plants. In Norfolk, a county famous for the culture of turneps, they dung their ground for this plant as much as they poſſibly can; even to ſuch a degree, that their dry-land meadows are quite impoveriſhed thereby [e]. Even Mr. Tull allows the neceſſity of dung in this caſe, becauſe, as turneps have commonly leſs time to grow than other plants, dung and tillage together will effect the neceſſary degree of pulveriſation, ſooner than plowing can do alone.

The land, for turneps, ought to be in the very fineſt tilth, of which having treated ſufficiently in the former part of this work, I ſhall only add here, that if the ground is not in ſo good order as the farmer ſhould wiſh, it muſt be laid up in ridges in the winter, to be mellowed by the froſt, and, by repeated plowings and harrowings during

[e] LISLE's *Obſervations in Huſbandry, Vol.* II. *p.* 26.

"ſandy grounds, than on clay; becauſe the former, though "unſtirred, is more penetrable by their roots, than ſolid "clay."

The Society is undoubtedly right as to means of pulveriſing clay, and of thereby rendering it light: but Mr. Liſle tells us [b], from his own experience, that turneps raiſed in clay-land are apt to be ſo rank as not to be eatable; and that thoſe which grow in a white lightiſh down-land are always very ſweet; though this laſt is generally accounted the worſt of all ſoils for this root. Turneps ought, in clay-ground, to be but juſt harrowed in with a buſh, as light as may be; for they will not be able there to grow to their full dimenſions, and their being checked in their growth will make them knotty and ſticky.

[b] *Obſervations in Huſbandry, Vol.* II. *p.* 35.

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the ſpring and in the beginning of the ſummer, it muſt be brought to that proper ſtate.

M. Duhamel has had ſurpriſingly large turneps in ground looſened to the depth of three feet: but he does not adviſe going quite ſo deep, becauſe that would be too expenſive [g]. However, it proves the advantage of deep plowing.

This plant has alſo ſucceeded perfectly well when ſown on ground made mellow by a crop of rank peas, and only harrowed in without plowing [h].

The common ſeaſon for ſowing of turneps is any time from the beginning of June to the middle of Auguſt, or even a little later; and, if poſſible, juſt before a ſhower of rain*: but it is not adviſeable to ſow them much later than Auguſt, becauſe, if the autumn ſhould not prove very mild, they will not have time to apple before winter; nor will the roots of thoſe which are ſown after the middle of July grow very large, unleſs the froſt keeps off long in autumn. The ſeed muſt be harrowed in as ſoon as it is ſown, with a ſhort tined harrow, and the ground rolled with a wooden roller, to break the clods and make the ſurface even: but it ſhould not be buried above an inch deep, eſpecially if it be that of the large ſort which grows almoſt out of the ground. Two pounds of ſeed are full ſufficient for an acre of land ſown broad-caſt: but one pound is the common allowance in that way. Three or four ounces

[g] *Eléments d'Agriculture, Tom.* II. *Liv.* 9. *c.* 4. Art. 3.

[h] LISLE's *Obſervations in Huſbandry, Vol.* II. *p.* 32.

* This ſeed, ſays the Edinburgh Society, ſhould be ſown in a moderate rain, or immediately after it: but if the ſeaſon ſhould continue long dry, and the time of ſowing be like to go over, it is adviſed, rather than to wait too long, to ſteep the ſeed in ſoft water ten or twelve hours, then to dry it with powdered chalk, and ſo to ſow it immediately. MAXWELL's *Collection, p.* 19.

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are the uſual quantity to drill, as will be obſerved in the account of that method, which will follow this.

Turneps ſhould always be ſown upon an open ſpot of ground: for if they are near hedges, walls, buildings, or trees, they will draw up and be very long topt, but their roots will not grow to any ſize. They are ſown in great plenty in the fields near London, not only for the uſe of the kitchen, but for feeding cattle in the winter, when there is a ſcarcity of other food: and this way is become a great improvement to barren ſandy lands, particularly in Norfolk, where many perſons have doubled the yearly value of their ground by the culture of this plant.

No ſeed is ſo uncertain as that of turneps; for, frequently the plants riſe only in patches, in which caſe the ſurface of the vacant ſpaces muſt be looſened with a hand-hoe, and freſh ſeed muſt be ſown, and covered over with a rake: at other times, huſbandmen have been obliged to ſow the whole ground, quite anew, two or three times before it would take. The chief expence here is, indeed, the labour; for this ſeed is very cheap: but the ground ſhould always be looſened, eſpecially if it be ſtiff land, either by hoeing or by harrowing, before it is ſowed. If all theſe precautions fail, as they ſometimes do; or if the fly, which is a cruel enemy to this plant, has eaten off the young crop, ſo as to render it not worth the farmer's while to let the remainder ſtand; M. Duhamel adviſes[1] plowing up the field and ſowing it with vetches, for green fodder; or leaving it till autumn, then to give it a plowing, and to ſow it with wheat.

[1] *Eléments d'Agriculture, ubi ſupra.*

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Mr. Liſle is inclined to think [k], that the beſt way to manage turneps (the ſeed of which, ſays he, is impatient of growth, and apt to burſt in too much wet, as alſo to corrupt, if the ground be ſo dry as only to give it a damp, but not wet enough to ſet it on growing) is, firſt to harrow the ground fine, after it has been brought to a perfect tilth by plowing, then to roll it with a roller big enough to break the little clods, if any ſuch remain, and ſo let to it lie till the next rain; then, the ground being mellow, to ſow the ſeed, and harrow it in with ſhort-tined harrows, which may not open the ground too deep, nor bury the ſeed; then roll it again with a one-horſe roller, in order to keep the moiſture in the ground as deep as the ſeed may lie: for the ſurface of the earth muſt not be dried before the ſeed can ſtrike root, which may be in twice twenty-four hours; and yet that ſurface muſt be ſo fine, and ſo lightly compreſſed, that the ſeed may ſpear through it. He takes the myſtery, as he calls it, of the ſucceſs or miſcarriage of a crop of turneps to conſiſt in theſe four things, viz firſt in the ſeed's not lying too deep; ſecondly, in it's not lying too wet, which it cannot eaſily do if harrowed in ſhallow, for the ſurface of the earth is ſoon dry; thirdly, in it's not lying too dry; and fourthly, in it's lying in a fine bed. In another place [l], he tells us, that his gardener affirmed to him, that he had found turnep ſeeds, which had been dropped by accident and covered over with earth in digging, freſh and good a year after, when the earth was turned back again, and that it has then grown and produced good turneps: the reaſon of which he takes to be, that when this ſeed lies on, or very near the ſurface of the ground, nine or ten days of hot weather will

[k] *Obſervations in Huſbandry, Vol.* II. *p.* 33. [l] *p.* 32.

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parch it ſo as to render it incapable of growing ever after: but in this caſe it was turned a ſpade deep under ground.

If the ſeed grows, the plants will appear in a few days if the ſeaſon is moiſt; but it will be longer before they come up in dry weather, and then it is that they will be in moſt danger of being deſtroyed by the fly. When the plants have got four or five leaves, they ſhould be hoed to deſtroy the weeds, and to thin thoſe which grow too cloſe together, leaving the remaining ones about ſix or eight inches aſunder, which will be room enough for the plants to ſtand for the firſt hoeing; and the ſooner this is done after they have four or five leaves, the better they will thrive: but in the ſecond hoeing, which muſt be performed about a month or three weeks after the firſt, eſpecially if the ground be much ſubject to weeds, the turneps, which will then be about as big as common apples, ſhould be cut up, ſo that the plants may ſtand fourteen or ſixteen inches from each other, or even more, eſpecially if they are deſigned for feeding of cattle; for where the roots are allowed a good ſpace to grow in, they will be proportionably large: ſo that what is loſt in number, will be over-gained by their bulk. But in places where they are ſown for the uſe of the kitchen, they need not be left at a greater diſtance than ten inches or a foot, becauſe large roots are not generally eſteemed for the table. After theſe two hoeings, inſtead of the firſt of which M. Duhamel adviſes a ſlight plowing all over the field, with a plough that has no fins to the ſhare, as a ſpeedier and cheaper way to thin the plants, the turneps will not require any farther care. They will have attained their full ſize in October, before the froſts come, and ſhould then be taken up, ſtripped of their leaves, which may be

be given to cattle, and laid upon hurdles in a dry place, with a layer of dry ſand between each layer of turneps, which may be thus piled up, and which will keep very well in this condition, for the food of cattle during the winter[m]. In Norfolk, they ſtow them in their barns, when intended for fattening of bullocks.

A dry ſeaſon is the beſt for hoeing turneps, becauſe neither the weeds nor the turneps hoed up then will be ſo apt to grow again: and Mr. Liſle ſuppoſes that care ſhould be taken to hoe up thoſe that are deepeſt rooted in the earth, and to leave thoſe that grow upon, and almoſt out of it, without much regarding their ſize; becauſe thoſe which lie on the ground, and have room to grow, will ſoon become the largeſt.

Some ſow turneps on their flax and hemp grounds, at the ſame time as they pluck up thoſe plants, and the ſeed is pretty well buried by the ſtirring thereby given to the earth. Others give their corn ſtubble only a ſlight plowing after harveſt, then ſow the turneps very thin, and harrow in the ſeed. Theſe methods do very well when the ground is in good tilth. Others again, ſow late turneps, merely for the ſake of their leaves, which they uſe as green feed, when they are about a foot high; and in this caſe they ſow the ſeed very thick.

An eaſy way to have two growths of turneps in the ſame field, is to ſow ſeed of the laſt gathering, and ſeed that is two years old; for this laſt is longer before it riſes, than the new: and an advantage attending this method, is, that the turneps, by riſing at different times, will have the better chance to eſcape the fly, or grub, which

[m] *Eléments d'Agriculture, Tom.* II. *p.* 176.

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ſometimes deſtroy them entirely: for it has been obſerved, that theſe flies often come ſuddenly in great ſwarms, and eat up the turneps as faſt as they riſe; and that they ſometimes diſappear as ſuddenly; ſo that the turneps which riſe a few days after, in a neighbouring field, are not at all injured by them: conſequently, when the turneps of the ſame field riſe at different times, one or other may eſcape the ravage of theſe inſects; for they deſtroy them only while in their ſeed leaf. The danger is over when they have put out their rough leaves pretty ſtrong, as they will in a few days, if rain falls when they firſt come up. Dry weather at that time is conſequently much to be feared.

One of the moſt effectual ways to guard againſt theſe inſects, is to run a heavy roller over the whole field if ſown in broad-caſt, or acroſs the rows if the turneps have been drilled, as will ſpeedily be directed. This rolling hardens the ſurface of the earth ſo that they can neither get in or out; by which means they are deſtroyed. But this preſſure of the earth will be very hurtful to the plants, if the ground has not been deeply plowed, if it be moiſt, or if it be ſtiff and apt to bind. Theſe inconveniencies are, indeed, partly remedied in the new culture, by hoeing the alleys as ſoon as the turneps have put forth their large leaves; for then, as I have juſt obſerved, they have nothing to fear from the inſects, which the hoeing likewiſe helps to deſtroy. The horſe-hoe is the only inſtrument with which this work can be well done; the earth being often ſo hard that the hand-hoe would only ſcratch it.

Of the many boaſted receipts for preſerving turneps from the fly †, few deſerve any notice. I

† The fly which preys upon turneps is not unlike the weevil in corn: it is nearly of the ſame ſhape, and alſo has hard wings.

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therefore ſhall only mention two or three, which Mr. Miller recommends, as having ſeen them tried with ſucceſs[n]. The firſt is, ſteeping the ſeeds in water mixed with ſo much flower of brimſtone, as to make it ſtrong of the ſulphur*: another is, ſteeping it in water mixed with a quantity of the juice of horſe-aloes. The ſowing of ſoot, or tobacco duſt, over the young plants, as ſoon as they appear above ground, has alſo been found to be very ſerviceable; and this may be done very eaſily along the ſurface of each drill, if the turneps are cultivated according to the new huſbandry, of which I am going to ſpeak; after obſerving, that caterpillars are another bitter enemy to this plant, which they very often attack even when it is grown ſo large as to have ſix or eight leaves. The ſureſt method of deſtroying theſe inſects is to turn a ſufficient number of hungry poultry early in the morning into the field: they will ſoon devour the inſects, and clear the turneps. Thoſe that are ſown in drills are leaſt expoſed to this evil; becauſe the frequent ſtirring of the ground between the rows keeps the plants conſtantly growing, and they are therefore the leſs injured by theſe inſects.

The worm to which turneps are very liable may be guarded againſt, at leaſt in a great meaſure, as Mr. Liſle informs us[o], by liming the ground.

[n] *Gardner's Dict.* Art. RAPA.

[o] *Obſervations in Huſbandry, Vol.* II. *p.* 26.

* In the Daily Advertiſer of July 11, of this year (1763), is the following receipt, which is there ſaid to be an approved method for preventing the fly in turnips. "Steep the ſeed in chamber-lye, ſix hours; then drain the liquor off, and ſtrew the ſeeds with as much flower of brimſtone, or *ſulphur vivum*, as will render them dry enough to ſeparate. Let them then be ſown in the uſual manner." I give my authority; and think that this may be full as likely to ſucceed, as the receipt certified by Mr. Miller.

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This will alſo render them much ſweeter than they would otherwiſe be: and I am of opinion that freſh ſlaked lime ſtrewed over the ground when the turnep ſeed is ſown, will contribute greatly to preſerve the young plants from the fly. It is to the worm lodged in the root of the turnep, perhaps engendered from the egg of the fly, that Mr. Liſle imputes [h] the diſtemper or diſeaſe in turneps, which the Norfolk farmers call the hanbery; ſo named from a like diſtemper in a horſe's heel. It is a warty excreſence, formed probably by this inſect, in the ſame manner as galls are formed upon the leaves of the oak. In ſome years it takes off whole crops, and the turneps never thrive after it has begun to grow in them.

A gentleman, remarkable, among many other good qualities, for ſeveral excellent improvements which he has made in agriculture, tried with ſucceſs the following experiment, to preſerve turneps from the fly, and the better to ſecure their growth. He ſowed the ſeed in a nurſery, where there was leaſt danger of ſlugs or the fly, and where they might eaſily be watered in caſe of great drought, to make them grow the quicker. They remained in this nurſery, till they were large enough to be tranſplanted. By this means he gained ſome weeks longer, to perfect his fallow, or give a thorough plowing to ground which had borne a crop that ſeaſon. He tranſplanted his turneps into the field, and by planting them regularly at due diſtances, greatly leſſened the expence of hoeing; their regularity making it very eaſy to deſtroy the weeds from time to time, as they appeared. If the ſeaſon is dry, they may be carried from the nurſery to the field in veſſels full of very moiſt earth,

[h] *Ibid, p.* 36.

as hereafter adviſed by M. Chateauvieux, in his directions for tranſplanting lucerne.

I have juſt now the pleaſure of receiving the Memoirs of the truly laudable Society of Berne for the year 1762, in the ſecond part of which the reverend Mr. Bertrand ſets a noble example. Not ſatisfied with even a ſcrupulous diſcharge of the duties of his clerical function, he alſo inſtructs his pariſhoners, his country, and mankind, in the important ſubject of agriculture. The improving of light ſoils by the culture of turneps, is one of his objects: upon which he very judiciouſly obſerves[q], that though it be right to plow ſtiff lands before the winter, in order to their being mellowed by the froſt; yet as the fineſt and beſt parts of the ſoil will be in danger of being waſhed off, or carried down into the looſe earth underneath, when this is done in a light ground, or in mould which has a ſandy or gravelly bottom; it will be moſt adviſeable here, to turn the ſtubble down immediately after the corn has been taken off, and then to ſow turneps: becauſe their ſpreading leaves will ſhelter and ſecure the fine mould upon the ſurface, and keep the land in good heart, whilſt the earth will be looſened and divided by their roots, ſo that it will be rather fitter for a ſpring crop, than if it had lain uncultivated.

The chief uſe of turneps is, to feed cattle in the winter and ſpring, when there is a want of graſs for their paſture. Cows, oxen, and hogs, are very fond of this food, which fattens them, and increaſes the milk of the former. Sheep too eat it readily, and thrive upon it*, when they

[q] p. 58.

* Parſley corrects the inconveniencies which may ariſe from the too great moiſture and coldneſs of the turneps, and therefore muſt be of ſingular uſe in wet low paſtures, as will be farther noticed hereafter.

have

have been uſed to it early; but they do not reliſh it when it has not been offered them till they are grown old: however, if they are kept faſting two or three days, moſt of them take to it, and when they have once taſted it, they become very fond of, and feed kindly upon it. In ſome places, they feed their lambs with turneps till the middle of April, though they then begin to run up to ſeed. Farmers chooſe rather to do this, than to let them hurt their clover, ſain-foin, lucerne [r], &c. Some par-boil them a little, at firſt, till their cattle, and particularly their ſheep, are accuſtomed to them [s]: but a lamb only three weeks old, will, after it has once eaten of this food, ſcoop out a raw turnep with great glee.

Turneps, if not clean eaten, and well cleared off the ground, may take root again, run to ſeed, and do great damage to the enſuing crop. Mr. Liſle inſtances it [t] in a gentleman of Berkſhire, who plowed up a a turnep field in the ſpring, and ſowed it with peas: but the little dwarf turneps that were left behind, uneaten, notwithſtanding his plowing them up, took root again, run to ſeed in great quantities, and did much damage to his crop of peas.

The practice of turning a flock of ſheep, at random, into a large field of turneps, is very bad: for they will then ſpoil more in a fortnight, than would keep them a whole winter. The beſt way, therefore, of feeding them with theſe roots, is, as Mr. Tull adviſes [u], and after him M. Duhamel [w], one or other of the three following methods,

r Duhamel, *Culture des Terres*, *Tom.* I. *c.* 14.

s *Idem*, *Elements d'Agriculture*, *Tom.* II. *Liv.* 9. *c.* 4.

t *Obſervations in Husbandry*, *Vol.* II. *p.* 35.

u *Horſe-hoeing Huſbandry*, *c.* 8.

w *Culture des Terres*, and *Eléments d'Agriculture*; *ubi ſupra.*

which are equally applicable to the drill, and to the common, huſbandry.

The firſt is, to portion out the turnep ground, by incloſing with hurdles ſo much only as the ſheep can clear in one day; and ſo to advance the folds farther into the field every morning, until all be ſpent. But it is to be obſerved, that the ſheep never eat them clean this way, but take only the leaves and the heart of the turnep: ſo that great part of them remains in the earth. It is true that theſe fragments, if left there, rot, and become a manure: but when they are wanted for the food of the flock, and are to that end pulled up with iron crooks or forks made for this purpoſe, the ſheep do not reliſh, and conſequently eat but little of, theſe then dirty withered remains, tainted with their urine, dung, &c. nor can they nouriſh them ſo well as roots which are freſh and cleanly.

The ſecond method differs from the former only in pulling up the turneps ſo far as they are hurdled off, before the ſheep are turned in. They then eat them better, becauſe the food is freſh and in good condition. Beſides, as the whole turneps are pulled up more eaſily than their pieces can be, there is not ſuch waſte as in the other way. The turneps which grow next to the hurdles ſhould be thrown towards the middle of the ſpace hurdled off; becauſe they will be leſs liable to be tramp'ed upon and ſpoiled there, than nearer to the hurdle, where the ſheep run about moſt, in ſearch of means of eſcaping into the open field.

The third way is to pull up the turneps, and carry them into ſome other ground, and there ſpread them every day on a new place, where the ſheep will eat them up clean. This is done when there is land not far off, which has more need of dung than that where the turneps grow. The expence of carrying the turneps is compenſated by

ſaving

ſaving the price, or at leaſt the carriage and removing of the hurdles: only when the turneps are laid on a ſpot of graſs, as is frequently done in wet weather, the benefit of the dung and urine of the ſheep is loſt.

This method is requiſite when the field on which the turneps grow is wet; becauſe, 1, The ſheep would trample upon, and bury, part of the turneps, which would be loſt, 2, In treading that wet earth, they would poach it, and render it unfit for corn 3, By this means, a field may be dunged, as I have juſt ſaid, which wants it more than that where the turneps grew. 4, This muſt neceſſarily be done, if wheat has been ſown in the alleys between the rows of turneps, according to the prciniples of the new husbandry.

Turneps are always carried off the field, when they are intended to fatten the larger ſorts of cattle: and they ſhould be cut in pieces for them, leſt they choak themſelves with the whole ones. They are given morning and evening to ſtall-fed cattle, which in the intervals, eat likewiſe common fodder: but the turneps increaſe their appetite to ſuch a degree, that a middle ſized bullock, ſtalled for fattening, will conſume near 200 pounds weight of theſe roots in 24 hours, beſides hay; whereas, if nothing but hay were given him, he would hardly eat half the quantity that he will with the turneps. A healthy bullock, in only good plight at the time of his beginning to be fed with turneps, will be very well fattened in three months [n].

In Norfolk, and ſome other countries, great quantities of turneps are cultivated for the feeding of black cattle, which turn to great account in the farms where this is practiſed. The turneps

[n] DUHAMEL, *Elémens d'Agriculture, Tom.* II. *Liv.* 9. *c.* 4.

are taken off the ground before the land is wetted by the winter rains, and they are laid up in barns, where they keep perfectly well. By this method of feeding cattle, the farmer obtains a good dreſſing for his land. But Mr. Liſle ſays* it has been found by experience, that turneps do not fatten large cattle well after Chriſtmas, becauſe they then grow hollow and ſticky; though they will ſtill do very well for folding of ſheep.

Some intelligent farmers have, of late, cultivated turneps, by ſowing the ſeed in rows, with a drill plough. The diſtance between the rows has been different, according as their judgment has ſuggeſted, ſome having placed them three feet, others four, ſome five, and others again ſix feet, aſunder; and ſome having ſown the rows double, others ſingle. Theſe laſt, with intervals of ſix feet between the rows, have been recommended as the beſt method; and though the intermediate ſpaces here ſeem very wide, yet the crop produced on an acre of land ſown in this manner, has been much greater than upon the ſame extent of ground where the rows have been at but half this diſtance. Certain it is, that the fields in which turneps have been drilled and cultivated with the horſe-hoe, have conſtantly yielded much larger crops than thoſe which have been ſown in the common broad-caſt way, and only hand-hoed.

The late lord viſcount Townſhend was at the expence of making the trial of theſe two different methods of husbandry, with the greateſt care, by dividing the ſame field equally into different lands, which were ſown alternately in drills, and the intermediate lands in broad-caſt. The latter were hoed by hand, in the common way, and the others were cultivated with the hoeing plough.

* *Obſervations in Husbandry, Vol.* II. *p.* 7.

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When the roots were full grown, his lordſhip ordered an equal quantity of land, cultivated in each different way, to be meaſured, and the turneps to be drawn up and weighed. Thoſe cultivated with the plough were ſo much larger than the others, that the crop of one acre of the former weighed a ton and a half more than that of an acre in the other husbandry.

Mr. Tull ſays [p] he found by experience, that the beſt way of ſowing turneps is in ſingle rows, ſix feet aſunder. He ſowed them in double rows, alſo at that diſtance, but they did not do well: and he likewiſe ſowed them in ſingle rows, with intervals of only three feet. Theſe laſt yielded a greater crop than a neighbouring field which was ſown and managed in the common way: but neither the ſingle rows three feet aſunder, nor the double rows with intermediate diſtances of ſix feet, yielded, ſays he, half ſo much, as the ſingle rows ſix feet aſunder: from whence he concludes, that it is beſt to leave a ſpace of ſix feet between the rows; for that, if the alleys are well plowed, theſe turneps will thrive wonderfully, even though no other moiſture falls but the dew, which will ſink into the earth, to their roots.

However, notwithſtanding Mr. Tull's experiment, M. Duhamel is for ſowing turneps in double rows, if the intervals are of ſix feet; or if they are ſown in ſingle rows, he would have theſe rows be but four feet aſunder; which is the ſpace left between the rows of vines in Languedoc, and which is there plowed with oxen [q].

An ounce of ſeed will ſow as much land when drilled, as a pound will in the common way: and, if care be taken to diſtribute only the neceſſary

[p] *Horſe-hoeing Huſbandry*, c. 8.

[q] *Culture des Terres*, *Tom.* I. c. 14.

quantity, a great deal of trouble will be ſaved in the hoeing of the plants afterwards, to thin them. But it is eſſential to obſerve, I muſt again repeat it, that all roots, whether turneps, carrots, parſneps, parſley, or any other, always thrive beſt where there is a great depth of fine, light, well looſened mould. M. Duhamel trenched the whole of his kitchen-garden three feet deep: all his pot-herbs grew very fine, and his roots in particular were of a ſurprizing ſize[r].

M. Tull, by drilling his turnep ſeeds alternately at different depths in the earth, was ſure to ſucceed in one part or other, whether the ſeaſon was wet or dry. If wet, the ſeed ſlightly covered ſprouted firſt; and in dry ſeaſons, that which lay deepeſt was the firſt that roſe. By this means, and by mixing the ſeed, half new and half old, for the new always comes up ſooneſt *, he had four comings up, which, as he obſerves, gave the plants ſo many chances to eſcape the fly.

If one was ſure of having rain immediately after the turneps are ſown, it would undoubtedly be right to ſow them very ſhallow: but if no rain happens, they are beſt deeper in the earth, becauſe they there meet with moiſture ſufficient to make them grow.

When the ſeaſon has been ſo kindly that all the ſeeds have grown, and the plants have not ſuffered by the fly or other inſects, they muſt be thinned early, that the ground may not be exhauſted by ſuch as are not intended to remain; for thoſe that are left ſhould be about a foot aſunder.

When the turneps ſown in drills thrive well, only each alternate alley need be hoed at one time, and the others a few days after; it being better

[r] *Ibid.*

* Mr. Tull ſays the difference is a day.

to

to feed the plants gradually, by dividing the hoeings in this manner, than to give them a great deal of food at once, by hoeing all the alleys together, and afterwards leave them double the time without any culture at all. Another advantage attending this method is, that the plants will be the leſs liable to be killed by hot dry weather, and the leſs apt to be damaged by heavy rains. But it will not, indeed, ſo effectually deſtroy weeds, which ought always to be a principal object of the huſbandman's care, and which ever is one of the chief intentions of the new huſbandry. However, as all weeds are very apparent in the alleys, it is eaſy to extirpate them there; and as to thoſe which may chance to be in the rows, the perſon who thins the turneps may cut them up at the ſame time. He will there moſt eaſily diſtinguiſh the charlock from the turneps, eſpecially when the leaves of theſe laſt are come to be about the breadth of a half crown.

By this alternate hoeing of the alleys, the plants will be the leſs expoſed to ſuffer from the earth's being thrown up too high on ſome rows, while others may be left too bare: for when the earth has been thrown up on one ſide of the drill, it may be turned down again before the next interval is hoed.

An expert husbandman will bring the horſe-hoe to within two or three inches of the plants: but as this inſtrument cannot plow between them in the rows, the remaining ground there ſhould be forked, to looſen it's parts, and make room for the fibres of the roots to ſtrike out into the intervals: otherwiſe, if the land is ſtrong, it will become ſo hard in thoſe places which are not ſtirred, as to ſtint the growth of the turneps. This may be done at a ſmall expence, and in very little time, as the other hoe has before ſtirred all the

reſt

reſt of the ground: and Mr. Miller anſwers, as doth reiterated experience, that whoever practices this will find his account in it, eſpecially on all ſtrong land, where the turneps are moſt liable to ſuffer from the binding of the ground: though it will be of ſignal ſervice in every ſoil; for the frequent ſtirring of the earth will not only greatly improve the plants actually growing on it; but, as I have conſtantly endeavoured to inculcate, it will prepare the ground admirably for the ſucceeding crop.

All plants ſown in ſingle rows are greatly benefitted by this alternate hoeing of the alleys between them: for, as M. Duhamel obſerves[3], 1. Four of theſe hoeings, which coſt no more than two entire ones, are almoſt as beneficial to the plants as four complete hoeings. 2. A plant which finds a great deal of nouriſhment on one ſide, is the better able to thrive without receiving ſo much on the other. 3. If, in hoeing very near the plant, ſome of it's roots are broke; thoſe on the other ſide, not hoed, ſupply the wants of the plant, till the broken ones have made freſh ſhoots. 4. The horſe-hoe may therefore be brought very near to the turneps, without fear of hurting them; provided it do not force them out of the earth. 5. When a farmer has a great quantity of turneps to hoe, they are ſooner ſupplied by this culture, than they could poſſibly be if all the alleys were to be hoed.

A furrow ſhould not be left open near the turneps, while they are young; becauſe the earth about them would in that caſe become too dry: but there is no danger of this in the autumn, when they are grown ſtrong, and the earth is moiſt. Neither is it adviſeable to leave a furrow open

[3] *Culture des Terres, Tom.* I. *p.* 168.

near

near them during the winter; becauſe they would be in danger of being hurt by the froſt.

When theſe plants are grown large, and their roots are conſequently pretty well extended, the hoe-plough need not come quite ſo near them as at firſt: nor is it neceſſary to hoe them at all, till they are about the bigneſs of one's finger's end.

One alternate hoeing, or, which is the ſame thing, two half hoeings, will be ſufficient when the turneps are ſown late. But when they are ſown early, and many weeds grow, one hoeing will not be enough.

By following this culture, M. Duhamel has ſeen† turneps which weighed from ſixteen to nineteen pounds; and we may depend on their weighing one with another, twelve pounds a-piece in a good ſoil, which is a vaſt produce from an acre of land. Mr. Miller ſays, that one acre of turneps, thus properly cultivated, will afford more feed for ſheep or ewes in the winter, than fifty acres of the beſt paſture at that ſeaſon.

Another vaſt advantage which attends the ſowing of turneps in rows, is, that inſtead of occupying the whole ground when it ſhould be ſowed with wheat, and ſometimes even when it ſhould be ſowed with ſpring-corn, as is frequently the caſe in the old way; they are no hindrance to either in the new husbandry: for as the alleys are in good tilth, three rows of corn may be ſown, ſeven inches aſunder, between the rows of turneps; and when theſe roots are pulled up, the ground where they grew is hoed, and becomes the alleys between the beds of corn.

The beſt turnep ſeeds are obtained from the largeſt roots, which may either be tranſplanted for that purpoſe, or marked out in the field where

† *Ibid. p.* 170.

they

they were ſown. Thoſe which are commonly ſold in the ſhops, ſeldom produce the fineſt plants.

I ſhall cloſe this article with the following

Experiments on Turneps cultivated according to the New Huſbandry.

IN 1754, M. de Chateauvieux ſowed turneps on beds, in two rows [u]. They ſuffered greatly for want of rain, and none of them grew to the ſize they would have done in a more favourable ſeaſon. Some of them weighed eight pounds; but their general weight was from three to four.

In 1755, M. de Chateauvieux ſowed ſome beds with one row, ſome with two, and others with three rows [x]. They were afterwards thinned, ſo that the plants ſtood a foot aſunder in the rows. Thoſe ſown in one row were the largeſt, and, in general, the moſt equal. Some of them weighed fourteen pounds, and moſt of them from ſeven to eight. In the other rows, they did not weigh ſo much; but they were more numerous.

In conſequence of theſe experiments, M. Duhamel, to whom they were communicated, makes the following ſtriking calculation relative to the quantity of food which turneps will afford for cattle [y].

"Let a ſquare whoſe ſide is 216 feet be formed into beds four feet wide, which is ſufficient for one row of turneps. Theſe will be 216 feet long, and conſequently will contain that number of turneps, planted a foot aſunder. Theſe 216 multiplied by 54, the number of beds, will give 11664 turneps for the product of the ſquare; and theſe multiplied by ſix, the ſuppoſed weight of each turnep,

u. DUHAMEL, *Culture des Terres, Tom.* V. *c.* 5.

x *Ibid. Tom.* V. *p.* 547.

y *Culture des Terres, Tom.* V. *c.* 5. *p.* 547. and *Eléments d'Agriculture, Tom.* II. *Liv.* 9. *c.* 4.

will

will give 69,984 pounds for the weight of all the turneps on this ſpot." This may be looked upon as a very conſiderable crop; for it will be ſufficient to ſtall-feed four bullocks during the three winter months, at the daily allowance of 200 pounds each: and yet there is reaſon to believe that the quantity will be doubled in a good year, as will be pretty evident to thoſe who conſider at how low a rate the medium weight of the turneps is here eſtimated.

In 1755, M. Duhamel ſowed turneps in a field, on beds cultivated with the horſe-hoe. They grew extremely fine; many of them being 29 inches in circumference.

ARTICLE II.

Of Carrots, Parſneps, and Parſley.

I Claſs theſe together, becauſe their culture is alike.

The Flemings have long known the advantage of feeding their cattle with *Carrots*; though it be but of late years that this root has been cultivated for that purpoſe in the fields in England: nor does this uſeful and profitable practice extend even now to more than a few parts of this country; though there is ſcarce any root yet known, which is more heartening food for moſt ſorts of animals, or which better merits the huſbandman's attention, if Mr. Miller be right, as I believe he is, in ſaying [a], that one acre of carrots, well planted, will fatten a greater number of ſheep, or bullocks, than three acres of turneps, and that their fleſh will be firmer and better taſted. Horſes are extremely fond of this food, and there is not any

[a] *Gardener's Dict.* Art. DAUCUS.

better

better for hogs. Theſe roots have alſo been of ſuch excellent ſervice to deer, in parks, that when numbers of theſe valuable creatures have periſhed elſewhere, through want, in very hard winters, when there has been an extreme ſcarcity of their uſual food; thoſe that have been fed with carrots have kept their fleſh all the winter, and, upon the growth of the graſs in the ſpring, have been fat early in the ſeaſon. This is not an inconſiderable advantage, in places where the graſs is generally backward in its growth.

But another, and that a very great, ſuperiority which this plant has over turneps, is, that the crop is not ſo liable to fail: for as the carrots are ſown in the ſpring, the plants generally come up well; and unleſs the months of June and July prove very bad, there is no danger of their ſucceeding: whereas turneps are frequently deſtroyed by the fly at their firſt coming up; and in dry autumns they are attacked by caterpillars, which lay waſte whole fields in a ſhort time. But carrots are not preyed upon by either of theſe vermin. Every farmer who has a ſtock of cattle or ſheep ſhould therefore always have good ſtore of theſe roots. His land will be fit for them, if it is in the proper tilth before directed.

Here I muſt again make one particular, as well as general, obſervation, which is, that, for carrots, and all tap-rooted plants, the ground ſhould be plowed as deep as the nature of the ſoil will permit, and brought to as fine a tilth as poſſible; for the more this is done, the thicker and longer the plants will be.

One pound and a half of ſeeds, which ſhould be ſown in March, will be ſufficient for an acre of land. Theſe ſeeds are ſo very apt to cling together, that they are more difficult to ſow than almoſt any others. Mixing them with a quantity of dry ſand,

and

and then rubbing the whole well together, is as good a way as any to ſeparate them. After they are ſown, they muſt be lightly harrowed in, to bury them; and when the plants are come up, they muſt be hoed and thinned, ſo as to be left ten inches or a foot aſunder. The hoeings muſt be repeated frequently, to keep them clear from weeds, and no other crop ſhould ever be ſown with them, if it be intended that they ſhould have large roots fit for fodder; unleſs it be parſneps, which require the very ſame culture, and which may be profitably uſed for the ſame purpoſe.

The horſe-hoeing huſbandry, managed as before directed for turneps, will make them grow to a ſurpriſing ſize. M. de Chateauvieux has given us a proof of it in the following part of an experiment which he made in order to ſatisfy himſelf whether pot-herbs, in general, may not be cultivated in the ſame manner as wheat is in the new huſbandry, without dung, and without the expenſive labour and attendance beſtowed upon them in the common way.

Of three beds [b], each forty feet long and ſix feet wide, he ſowed two with carrots, and one with beets. The plants were thinned where they grew too thick, ſo as to leave a diſtance of ſeven or eight inches between the carrots, and 14 or 15 inches between the beet-roots. Though neither of theſe was ever watered (for ſuch is the excellence of the new huſbandry when properly executed, that ground perfectly looſened to a good depth, always retains moiſture enough for the plants upon it), the leaves of the beets were three or four inches broader than thoſe of the ſame kind of plants in his kitchen garden (which had been well dunged); and though the rows were ſix feet aſunder,

[b] DUHAMEL, *Culture des Terres, Tom.* II. *part.* 3. *c.* 1. *p.* 333.

the

the leaves of the carrots met in many places, in the middle of the furrow between the beds.

The beet-roots, which I have purpoſely retained in this experiment, becauſe I think it may be well worth while to try whether they will not be very good food for cattle, were dug up on the 25th of October, and were all nearly of the ſame ſize, which was from 5 to 6 inches in diameter towards their top, or thickeſt part.

The carrots were dug up on the 8th of November, and, to the aſtoniſhment of M. de Chateauvieux's gardener, who would have betted all he had in the world, that the crop would not be worth digging, they meaſured from 18 to 20 and 25 inches in length, and from 2½ to 3½ and 4 inches in diameter, and weighed from 25 to 30 and 33 ounces each.

To preſerve the carrots for uſe all the winter and ſpring, they ſhould be dug up about the beginning of November, when their green leaves are decayed, and they ſhould then be laid in dry ſand, in a dry place, where the froſt cannot reach them, in order to be taken from thence as they are wanted.

Some of the longeſt and ſtraiteſt roots may be reſerved for ſeed, if it be intended to ſave any; and in this caſe they ſhould be tranſplanted in the ſpring into a light, and deep ſoil, where they ſhould be planted about a foot aſunder every way. This ground muſt be kept very clear of weeds; and when the ſeed is ripe, which will be about the middle of Auguſt, it muſt be cut off, and carried to a dry place, where it ſhould be expoſed to the ſun and air, for ſeveral days, to dry: it may then be beaten out, put into bags, and laid up in a dry place. This ſeed is ſeldom thought to be very good after the firſt, or at moſt the ſecond year: nor indeed will it grow after it is more than

two

two years old. New ſeed is therefore always preferred.

Parſneps are another excellent, wholeſome, and very nouriſhing food for cattle. Their culture, as I have juſt obſerved, is exactly the ſame as that of carrots, with which they may therefore be ſown in the ſame ground. Their leaves will decay at nearly the ſame time, when the roots may be dug up, and laid by for uſe, likewiſe buried in dry ſand, in a dry place.

Parſnep ſeeds ſeldom grow after they are above a year old.

It has long been a cuſtom in ſome parts of Britany, to ſow parſneps in the open field for the food of cattle; as we are informed by the firſt volume of the tranſactions of a Society inſtituted in that province, for the encouragement of the economical and commercial intereſts of their country. "It "is of great importance," ſay they [e], "that parſ- "neps ſhould be univerſally cultivated; becauſe "they afford an excellent and wholeſome food for "all kinds of cattle, during the winter, and may "be uſed to great advantage to fatten them. Our "hogs have no other food in all that ſeaſon, and "our bullocks and oxen thrive well upon it. Our "cows fed with parſneps give more milk than "with any other winter fodder, and that milk "yields better butter than the milk of cows nou- "riſhed with any other ſubſtance. Our horſes "fatten with this food; though ſome pretend "that it renders them leſs mettleſome, and hurts "their legs and eyes.

"Cattle eat theſe roots raw at firſt, ſliced "lengthwiſe; and when they begin not to reliſh

[e] *Corps d'Obſervations de la Societé d'Agriculture, de Commerce, et des Arts, établie par les Etats de Bretagne. Années* 1757 & 1758, *p.* 88.

"them, they are cut in pieces, put into a large "copper, preſſed down there, and boiled with "only ſo much water as fills up the chaſms be-"tween them. They then eat them very greedily, "and continue to like them."

The common garden *Skirret (Sium*, or *Siſarum)* may likewiſe, probably, do well for cattle; for it is a very nouriſhing root, and has a ſweet taſte. It's proper culture is exactly the ſame as that of parſneps and carrots, and there is no doubt of it's ſucceeding admirably in the new huſbandry; for M. de Chateauvieux's ſkirrets, cultivated with the hoe-plough, in an open field, were larger and more fleſhy at the end of ſix months, than thoſe in his kitchen-garden were at the end of nineteen; even though the former had been damaged by ſlugs[b]. The latter end of March, or the beginning of April, is the beſt time for ſowing them; and if the ſeeds are good, they will appear in five or ſix weeks after they are ſown.

Parſley is known to be ſo excellent a preſervative againſt the rot in ſheep, if they are fed with it twice a week, for two or three hours each time, that I cannot but regret the want of experiments on the culture of this uſeful plant, which would certainly ſucceed well in rows properly hoed, and prove a general benefit. The few ſkilful perſons who have raiſed it in the field for the uſe of ſheep, have found it turn to great account, though ſown only in the common broad-caſt way. How much then may be reaſonably expected from it's greater increaſe, and more perfect quality, when cultivated according to the principles of the new huſbandry! For that plants do attain a much higher degree of perfection in this way, than in the old method, has been conſtantly evinced, by frequently repeated,

[b] DUHAMEL, *Culture des Terres, Tom.* II. *p.* 340.

and

and always unvaried, experience. I therefore ſtrongly recommend this object to the Britiſh farmer, whoſe flocks, ſuperior to thoſe of every other country, are a principal ſource of the wealth and grandeur of this happy land, as well as a valuable treaſure to the individuals who poſſeſs them. It is likewiſe poſſible, or rather, perhaps, highly probable, that, as Mr. Worlidge obſerves in a letter to Mr. Houghton [c], on this ſubject, beſides preventing or curing the rot *, the taſte of the mutton may alſo be improved by this paſture; for it is very certain that the fleſh of all animals acquires a peculiar flavour from their food. This is particularly remarked in veniſon: and it is as invariable, that the ſweeteſt mutton is that which has been fed on the fineſt and ſweeteſt graſſes, as is experienced on the Peak in Derbyſhire, the plains in Wiltſhire, Hampſhire, &c. and the downs of Dorſetſhire, Banſtead, &c. whilſt, on the contrary, the coarſeſt and rankeſt mutton is produced from the groſſeſt meadows and marſhes.

The beſt time for ſowing parſley in the field is about the middle or latter end of February. The ground cannot poſſibly be in too fine tilth. Mr. Miller [d] mentions too buſhels of ſeed as a proper quantity for an acre of land ſown pretty thick in drills about a foot aſunder, which will, indeed,

[c] Houghton's *Collection*, *Vol.* IV. *No.* 12.

[d] *Gardiner's Dict.* Art. Apium.

* This diſeaſe is occaſioned by the ſheep feeding on too much cold and moiſt meat, ſuch as turneps, clover, and large rank graſs in low lands: it is beſt remedied by hot and dry food; and ſuch parſley is in a very high degree. For the ſame reaſon, thoſe that feed in ſhady places, in ſome grounds, where the dew lies long on a certain broad graſs, neceſſarily incline to the rot; and this is prevented by turning them into ſalt marſhes and brackiſh ground, or giving them ſalt with their dry food: for ſalt is eſteemed a cure for this diſeaſe. *Worlidge, in Houghton's Collection*, *Vol.* IV. *No.* 12.

be ſpace enough for hand-hoeing: but I am inclined to think, that the plants will flouriſh beſt, grow largeſt, and be in all reſpects moſt perfect, if the diſtance between the rows is ſufficient to admit a hoe-plough. Leſs ſeed will then be requiſite, the culture will certainly be performed cheaper this way, than by hand, and I am confident that the plants will be larger, and better for the food of cattle. The roots of the common great garden parſley will grow, in this way, to be at leaſt the ſize of a middling parſnep. Theſe roots may alſo be boiled, and eaten, as young carrots; for they are very palatable and wholeſome, eſpecially for thoſe who are troubled with the gravel. The Dutch are very fond of them for their *Water ſouches.*

Hares and rabbits are ſo fond of parſley, that they will come from a great diſtance to feed upon it; ſo that whoever chuſes to have plenty of thoſe animals in his fields, need only ſtock them well with this plant: he will ſoon draw to them all the hares of the country: but, at the ſame time, if his parſley is not fenced in very ſecurely, they will be ſure to deſtroy it.

Let us now conſider the manifeſt advantage of cultivating carrots and parſneps for the food of cattle.

On a bed ſix feet wide, three carrots will take up a ſpace of 12 ſquare feet: conſequently the acre will yield 10,890 carrots: and ſuppoſing each carrot to weigh but 28 ounces, which is rather under the medium weight of the carrots in M. de Chateauvieux's experiment, the above number will weigh 19,000 pounds. Now a bed ſix feet wide may, with great propriety, admit two rows of carrots, a foot aſunder; and in this caſe the produce will be nearly double. Or if we ſuppoſe the acre to be divided into beds four feet wide, it will

will contain 16,335 carrots, which, at 28 ounces each, will weigh 28,586 pounds.

As carrots are much more ſubſtantial than cabbages, which will be ſpoken of in the next ſection, as proper for the food of cattle; and as they are alſo more ſubſtantial than even turneps; cattle will, undoubtedly, eat proportionably leſs of them: but as the quantity which they will eat of this root has not been aſcertained by experiment, I can make no eſtimate thereof; but reſt ſatisfied that Mr. Miller has ſome facts to go by, when he ſays, that one acre of carrots will feed more cattle, than three acres of turneps.

The people of Flanders have found by long experience, that carrots agree ſingularly well with horſes, and that theſe creatures require much leſs corn when they are fed with them, than when they are fed with hay. Suppoſing, then, that a horſe can eat 50 pounds of carrots in a day; 28,586 pounds of carrots, the above product of an acre planted in beds four feet wide, will maintain two horſes, near ten months, with half their uſual allowance of corn.

If we conſider that parſneps grow rather larger than carrots, and that they are yet more nouriſhing and ſubſtantial; what has been ſaid of the quantity of carrots on an acre of land, and of their uſe, may juſtly be applied to parſneps. This is confirmed by the eſtimation ſet upon a crop of parſneps in Britany, where it is reckoned equal in value to three crops of wheat, even when an acre of this corn yields about four quarters[e]. Another advantage ariſing from theſe roots, is that they leave the ground prepared for any ſort of ſpring-corn.

[e] *Obſervations de la Societé de Bretagne, pour les années* 1757 & 1758. *p.* 90.

ARTICLE III.

Of Potatoes.

MR. Houghton deſcribes the potatoe* to be a bacciferous herb, with eſculent roots, bearing winged leaves and a belled flower; and ſays, that, according to his information, which is allowed to be very right in this reſpect, it was firſt brought from Virginia, by Sir Walter Raleigh †, who, ſtopping at Ireland, gave away a number of theſe roots, which were planted there, and multiplied ſo exceedingly, that, in the wars which happened afterwards in that country, when all the corn above ground was deſtroyed, potatoes became the chief ſupport of the people: for the ſoldiers, unleſs they had dug up all the ground where they grew, and almoſt ſifted it, could not have extirpated them. The Philoſophical Tranſactions obſerve likewiſe[f], that the Iriſh were relieved from their laſt ſevere famine, which laſted two years, during which all their corn failed, merely by the help of this root. From Ireland it was brought to Lancaſhire, now famous for it's potatoes: and the culture of this plant has, within theſe laſt thirty years, been extended to almoſt every part of England. The rich, who, at firſt, deemed them fit for none but the meaner ſort of people, now eſteem them ſo much that, Mr. Miller thinks[g] the quantity of them which is cultivated around

* Which is C. Bauhin's *Solanum tuberoſum eſculentum*, Eſculent tuberous Nightſhade. The name *Potatoe* is evidently a corruption of the Indian *Batatas*.

† About the year 1623.

[f] No. 90 and 134.

[g] *Gardener's Dict.* Art. LYCOPERSICON.

London

London only, exceeds that of any other part of Europe.

The red rooted potatoes have purpliſh flowers, and the white rooted (for Mr. Miller diſtinguſhes only theſe two general varieties) bear white flowers.

The potatoe ſeldom perfects it's ſeeds in England; and if it did, the raiſing of it from them would be much more tedious and uncertain than propagating it by it's roots, as is the general, and right method: for theſe multiply exceedingly, and may he made to yield vaſt crops, with little coſt, or labour.

As Ireland, is famed for it's crop of potatoes; as the culture of this plant has been longer and more univerſally practiſed there, than with us, or any other European nation; and as the Iriſh have always, very judiciouſly, looked upon this article as an object of great importance; it may naturally be ſuppoſed, that their huſbandmen excel in this reſpect. The reader may therefore not be diſpleaſed at the means of comparing their practice with the improved method which Mr. Miller adviſes. I ſhall tranſcribe the former from the account which Mr. Switzer ſays he received from a gentleman of good intelligence, and who was alſo a husbandman, then lately arrived from Ireland; and the latter, from Mr. Miller's elaborate dictionary.

"The Iriſh husbandman [h], after blaming the Engliſh for planting this root uncut, becauſe it often contains five or ſix eyes, or perhaps more, from which the produce of the enſuing year is to ſpring; and alſo for not allowing that bulb, or rather the great number of ſhoots and bulbs that proceed from it, a ſpace of earth ſufficienr for their

[h] SWITZER's *Practical Kitchen Gardener.*

nouriſhment, which is the reaſon why ſo many poor, ſtinted, unſerviceable, potatoes are dug up in the autumn, relates the practice of his country, which is, to chooſe middle ſized roots, for the largeſt are generally eaten, to ſingle out the eyes that ſeem ſtrongeſt and moſt vigorous, and to cut them out in ſquares of at leaſt half an inch every way: ſo that one root will ſometimes furniſh three or four good pieces to ſet.

" The ground, prepared for planting, is marked out for beds four or five feet wide, with intermediate alleys of two or three feet. It is then trenched, only a ſingle ſpit deep, and the bottom of this trench, made as in common garden-trenching, is covered with dung, long and ſhort, taken out of a wheel-barrow which ſtands at the labourer's elbow. The potatoe-eyes are cut as before directed, are placed upon this dung, at about five or ſix inches aſunder; and this trench is filled up with the mould taken out of the next, which is marked by a line at the diſtance of two or three feet. This trench is again filled with the mould of the next, and ſo on to the laſt, which is filled from the alley.

" The uſe of the dung thus laid at the bottom of the trenches, is not only to make the roots grow ſingle, for not above one root, or at moſt two, will in this caſe be produced by each eye, and theſe will be large and well fed; but it is attended with the farther advantage of making the potatoes run, and ſpread themſelves to a certain determinate depth, which is no ſmall help to their growing large.

" The laſt thing to be done to them is, in April or May (for they are planted in February or March), as ſoon as they begin to riſe, to dig the earth out of the alleys, as is done for aſparagus, and to cover the potatoe bed with it, about five

five or six inches thick. This will give new life and vigour to the roots, will keep the green from running too much to haulm, and will make the bulbs grow much the larger. By this means the crop of fine large potatoes will be almoſt the double of what is obtained when they are planted promiſcuouſly in the common way: nor will any farther culture be requiſite till they are fit to be dug up; except the pulling out of ſome of the largeſt weeds."

Mr. Miller's reaſons[i] for diſapproving of the planting, either of the ſmall offsets entire, or the eyes cut out of larger roots, are, that though the former generally produce a greater number of roots, theſe roots are always ſmall; and that the cuttings of the larger roots are apt to rot, eſpecially if wet weather happens ſoon after they are planted. He therefore recommends, to make choice of the faireſt roots for ſetting, and to allow them a larger ſpace of ground, both between the rows, and between the plants in the rows; and he aſſures us that he has obſerved, when this method has been followed, that the roots, in general, have been large the following autumn. M. Duhamel, in his Elements of Agriculture[k], does not object at all to the planting of the cuttings.

The ſoil in which this plant thrives beſt, is a light ſandy loam, neither too dry nor over moiſt, but brought to a fine tilth, and plowed very deep: for the deeper the earth is looſened, the finer and larger the roots will grow. In the ſpring, juſt before the laſt plowing (I am giving Mr. Miller's method), a good quantity of rotten dung ſhould be ſpread on the ground, and this ſhould be plowed in early in March, if the ſeaſon be mild; other-

i *Gardener's Dict.* Art. LYCOPERSICON.

k *Tom.* II. *Liv.* 9. *c.* 4.

wiſe

wiſe it had better be deferred until the middle or latter end of that month; for if a hard froſt ſhould come on ſoon after the roots are planted, they may be greatly injured, if not deſtroyed, thereby; but if they can be planted in the ſpring, without that danger, the better it will be.

The laſt plowing ſhould lay the ground even, and then furrows ſhould be drawn three feet aſunder, and ſeven or eight inches deep. The roots ſhould be laid at the bottom of theſe furrows, about a foot and a half aſunder, and they ſhould then be covered in with earth.

After all the ground intended for potatoes is planted in this manner, it muſt remain in the ſame ſtate till near the time when the ſhoots are expected to appear: then it ſhould be well harrowed both ways, as well to looſen the ſurface and render it ſmooth, as to tear up the young weeds which will have begun to grow by that time. If much wet has fallen after the planting, it may have caked the ſurface of the earth, ſo as to retard the ſprouting of the plants; and this harrowing will, in ſuch caſe, almoſt anſwer the intent of a firſt hoeing.

I have placed the rows of potatoes at three feet diſtance, continues Mr. Miller, in order to introduce the hoe-plough between them; becauſe that will greatly improve their roots: for by twice ſtirring and breaking of the ground between the theſe plants, not only weeds will be deſtroyed, but the ſoil will be ſo looſened, that every ſhower of rain will penetrate to the roots, and greatly quicken their growth. But theſe operations ſhould be performed early in the ſeaſon, before the ſtems or branches of the plants begin to fall and trail upon the ground: for after that, it cannot be done without injuring the ſhoots *. If

* The firſt horſe-hoeing, ſhould be given when the plants are about five or ſix inches high, and the ſecond when they are about

If theſe hoe-plowings are carefully performed, they will prevent the growth of weeds, till the haulm of the plants cover the ground; and after that there will be little danger of their growing ſo as to injure the crop; for the haulm will keep them under: but as the horſe-hoe can only go between the rows, it will be neceſſary to make uſe of a hand hoe to ſtir the ground, and deſtroy the weeds in the rows, between the plants. If this is well done, in dry weather, immediately after each of the two horſe-hoeings, it will be ſufficient to keep the ground clean until the potatoes are fit to be taken up; which will be, very ſoon after the firſt froſt in the autumn has killed the haulm. They ſhould not remain much longer in the earth, leſt the roots themſelves be froſt-bitten, which ſpoils them. A four or five pronged fork is better to dig them up with, than a ſpade, becauſe it is leſs apt to cut them: but a principal thing to be conſidered here, is the clearing of the ground thoroughly of them: for if any are left, they will ſhoot up among the next crop, whatever it be, and do conſiderable damage, eſpecially if it be wheat, as is generally the caſe, ſown in the common broad-caſt way.

The beſt way of keeping theſe roots during the winter, is, as before directed for carrots and parſneps, to lay them up in a dry place in very dry ſand, or in fine and perfectly dry earth.

The method of laying dung only at the bottom of the furrows in which the roots are planted, "is a very poor one, ſays Mr. Miller, becauſe, "where the potatoes begin to puſh out their "roots, they are ſoon extended beyond the width

about twelve or fifteen; and at each of theſe the rows ſhould be earthed up, but with great care not to cover any of their ſtalks. DUHAMEL, *Eléments d'Agriculture*, *Tom.* II. *Liv.* 9. *c.* 4.

"of

"of theſe furrows, and the new roots are com-
"monly formed at a diſtance from the old: ſo
"will be out of the reach of this dung, and con-
"ſequently will receive little benefit from it."—
But rather the contrary would ſeem to be the caſe, according to the Iriſh huſbandman, who, I ſuppoſe, ſpeaks from experience, when he ſays, as if he had intended expreſsly to anſwer this very objection, that "the dung is placed at the bottom
"of the furrows on purpoſe to make the roots
"grow ſingle; and that its being ſo placed is at-
"tended with the farther conveniency of making
"the potatoes run, and ſpread themſelves at a
"certain determinate depth, which is no ſmall
"help to their growing large."—Facts muſt here determine which is right: as they alſo muſt in regard to ſome parts of what Mr. Miller adds in the following words. "As moſt farmers covet
"to have a crop of wheat after the potatoes
"are taken off the ground, ſo the land will not
"be ſo thoroughly dreſſed in every part, nor ſo
"proper for this crop, as when the dung is
"equally ſpread, and plowed in all over the land,
"nor will the crops of potatoes be ſo good. I
"have always obſerved, where this method of
"planting the potatoes has been practiſed, the
"land his produced a fine crop of wheat afterward,
"and there has ſcarce one ſhoot of the potatoe
"appeared among the wheat, which I attribute to
"the farmers planting only the largeſt roots:
"for when they have forked them out of the
"ground the following autumn, there have been
"ſix, eight, or ten large roots produced from
"each, and often many more, and ſcarce any
"very ſmall roots; whereas, in ſuch places where
"the ſmall roots have been planted, there has
"been a vaſt number of very ſmall roots produced,
"many of which were ſo ſmall, as not to be diſ-

"covered

"covered when the roots were taken up; ſo have "grown the following ſeaſon, and have greatly "injured whatever crop was on the ground."

Will not a thorough plowing and good harrowing, after the crop of potatoes has been taken off the ground, intermix the dung laid in the furrows, and the contiguous earth moſt impregnated thereby, with the reſt of the ſoil; perhaps almoſt as well as if the dung had been ſpread equally over the whole field, at the very firſt? If it will, the preſumption ſeems ſtrong in favour of the Iriſh method. For certain it is, that the land ought to be well plowed and harrowed after the potatoes are removed, before it is ſown with any other crop; unleſs the ſeed for that crop, which generally is wheat, be ſprinkled by hand between the rows, as they are dug up, and there covered with the earth then turned over. This is practiſed in ſome parts of France: but, as M. Duhamel obſerves [m], the grain is ſo apt to be diſtributed unequally in this method, that it is better to plow the groumd, and ſow it, in the regular way.

If the farmer apprehends that his land has not been thoroughly cleared of the potatoes, and is therefore afraid of their damaging his enſuing crop; his beſt way will be to lay it up very rough againſt winter; becauſe the froſts of that ſeaſon are known to kill and rot all potatoes in the ground expoſed to them, and it will at the ſame time be thereby finely prepared for ſpring corn; eſpecially as it will have been well enriched by the haulm of the potatoes lying upon it.

Though potatoes delight moſt in a light ſandy loam, neither too dry, nor over moiſt, as was obſerved before; yet Mr. Maxwell ſays [n] he has ſeen

m *Eléments d'Agriculture, Tom.* II. *Liv.* 9. *c.* 4.

n *Miſcellaneous Papers on Husbandry, p.* 165.

them

them thrive well on ground that ſeemed to be very bad; even in deep moſs, which could not bear horſes to plow it, but which is conſiderably bettered by them; and on coarſe heath, where they were ſucceeded by grain, without more dung than was laid on at firſt. Of ſo improving a nature are they, and ſo much is the land enriched by the rotting of their ſtalks among it, and the digging it gets in raiſing them.

Several experiments communicated to M. Duhamel concur to prove the extraordinary increaſe of potatoes cultivated with the horſe-hoe: but as this will always be the conſequence of the new huſbandry, wherever it is properly uſed, I ſhall only borrow from him, on this occaſion, M. de Villier's account of his method of practice, becauſe it is the cleareſt and moſt conciſe.

"There are, ſays he*, ſeveral ſorts of potatoes. "That which I cultivate is the middle ſized. It "is planted about the end of April, or the begin- "ning of May, and it ripens in October. My "beds are five feet wide." I give them two "plowings in the ſpring; at the ſecond of which "I half-fill the main furrow. Before I plant, I "cut a ſmall furrow with the ſingle cultivator, "which likewiſe looſens the earth; but if it be "moiſt, I put a double ſpring-tree bar to the cul- "tivator, to avoid the poaching of the horſes. I "then plant the potatoes a foot aſunder in the "row; chooſing for this purpoſe ſuch as are about "the ſize of a walnut. They are thruſt in by "hand, two or three inches deep; and if the "mould does not then cover them ſufficiently of "its own accord, a little more is puſhed down "upon them.

* DUHAMEL, *Culture des Terres, Tom* V. *c.* 1. §. 14.

"A

" A ſlight hand-hoeing can hardly be avoided " afterwards, to deſtroy the weeds which ſpring " up at the ſame time as the potatoes: but this " hoeing need not extend farther than three or " four inches on each ſide of the row; becauſe " the plow will do the reſt.

" I give the firſt hoe-plowing in the ſpring, as " for wheat; but earlier or later, according to the " condition of the ground.

" My ſecond hoe-plowing is given as ſoon as " the plants are tall enough to be earthed up; " that is to ſay, when they are eight or ten inches " high. I then turn the earth up towards them " as much as poſſible.

" As this plant ſpreads greatly, and ſhoots out " very faſt, it would be impoſſible to give more " than two of theſe hoeings, if one ſhould neglect " to take advntage of the time when its leaves and " branches do not entirely cover the bed.

" The roots are dug up in October, or perhaps " ſomewhat earlier or later, according to the ſea- " ſon, with a ſtrong iron prong; ſhaking and " clearing them well from the mould. They are " then left to dry for ſome hours, and are after- " wards laid up in a place where the froſt cannot " reach them.

" This fruit, which yields ſurpriſingly, is of " great ſervice to feed and fatten cattle, eſpeci- " ally when it has been boiled a little. They like " it very well raw, after it has been kept a few " months above ground: but it is beſt for them " after it has been boiled."

SECT. II.

Of Plants whoſe Leaves and Seeds are uſed for the Food of Cattle.

ARTICLE I.

OF CABBAGES.

THE common large curled colewort, or borecole (*Braſſica fimbriata maxima*), and the perennial colewort (*Braſſica arborea* ſeu *procerior ramoſa*), are the ſpecies of cabbages moſt commonly, and moſt properly, cultivated for the food of cattle. The refuſe leaves of all the other ſorts of this plant do very well for them, but theſe are the beſt for raiſing in the field, becauſe they are by far the hardieſt, the moſt able to reſiſt froſt, and therefore the fitteſt to yield green food in the ſpring, when there is a ſcarcity of herbage. The common colewort is indeed ſo hardy, that no froſt will deſtroy it; and the perennial puts forth many ſhoots from it's ſides, after it has run up to ſeed, which is not till the end of two years. This will laſt three or four years in poor land; but not ſo long in rich ſoils.

The beſt way of cultivating theſe plants in the field, is undoubtedly by the horſe-hoeing husbandry, which makes them thrive amazingly, as will be ſeen by the experiments hereto annexed: and in this caſe the beſt time for ſowing them is about the beginning of July, and eſpecially in moiſt weather, for this will bring up the plants in about ten days or a fortnight. When they have got five or ſix leaves, they ſhould be hoed and thinned as before directed for turneps, carrots, &c. ſo as

to

to let them have full room to ſpread in the rows, the diſtance between which ſhould be ſufficient to admit the working of the hoe-plough. The hoeing ſhould be performed in dry weather, the better to kill the weeds, many of which will be apt to root again, if rain falls on them, and they are not carried off the ground. About ſix weeks after this, the plant ſhould have a ſecond hoeing, with the cultivator, or horſe-hoe, in the alleys, and by hand between the cabbages in the rows. If this is carefully performed, likewiſe in dry weather, all the weeds will be extirpated, the ground will be thoroughly cleaned, and the plants will not require any farther culture. In the ſpring, they may either be drawn up, and carried off the field, to feed the cattle; or, which is the practice of ſome places, the cattle may be turned in to feed upon them as they ſtand: but the former method is far preferable, becauſe that will occaſion little waſte; whereas, when the cattle are turned in among the plants, they tread down and deſtroy more than they eat, eſpecially if they are not fenced off by hurdles [r]. I need not repeat here, that the hoe-plough, or cultivator, ſhould be brought as near to the plants as it can be, without hurting them, and that the earthing up of the plants, with care, however, not to bury any of them too deep, will make them grow with redoubled vigour.

The fly and the caterpillar are as formidable enemies to cabbages as they are to turneps. Whatever prevents or deſtroys them in the one, will be equally ſerviceable for the other: but of all the means yet tried to anſwer this end, none has ſucceeded better than fine tillage, keeping the ground free from weeds, and frequently ſtirring it, according to the principles of the new huſbandry.

[r] MILLER's *Gardener's Dict.* Art. BRASSICA.

Mr. Miller allows nine pounds of ſeed for an acre of land; meaning, I ſuppoſe, in the common way of ſowing it: for I apprehend a leſs quantity will be ſufficient to drill that extent of ground in rows five feet aſunder, or even four feet, which is the leaſt that can here be allowed for the hoe-plough. It is true, that, as he obſerves, cabbage ſeed is very cheap: but this is no reaſon for crowding the plants in the rows, even at their firſt coming up; though it will be right to make a conſiderable allowance for what may be deſtroyed by the fly and caterpillar. When they are large, leſs than two feet diſtance from each other, in the rows, would cramp them too much, and prevent their attaining to thir full ſize.

I here ſpeak, in general, of the common ſorts of cabbages uſually cultivated in this country; and not of the cabbage ſhrub, or tree, as it is ſometimes called, which grows in the province of the Lower-Maine, in France[b], of which the excellent Marquis of Turbilly has, moſt obligingly, ſent a parcel of the ſeeds, from Anjou, where he has likewiſe propagated it, to our Society for the Encouragement of Arts, &c. who, with the patriotic ſpirit which characteriſes this illuſtrious aſſembly, have juſt ended the public diſtribution of them, purſuant to the donor's generous intention, to ſuch as have applied, in order to their being cultivated here *.

The extraordinary ſize of this plant, which will grow ten feet high, with leaves proportionably numerous and large, added to it's laſting two years;

[b] *Maiſon Ruſtique, Tom.* I. *Part.* 2. *Liv.* I. *c.* 11. *p.* 677.

* We have already ſeen (*Vol.* I. *p.* 161) with what ſuperior judgment this nobleman improved a forſaken bog, and raiſed upon it, beſides excellent beans, peas, potatoes, turneps, and carrots; well taſted cabbages, which, though only of the common large hard ſort, weighed forty pounds a-piece.

ſecure

ſecure ſucceſs to thoſe who ſhall cultivate it properly, even though it be only for the food of cattle: but the Marquis aſſures us, that it is alſo the tendereſt, the ſooneſt boiled, and the ſweeteſt taſted, of perhaps any kind of cabbage. The right way of gathering theſe leaves is, always to ſtrip off the undermoſt, as the plant grows; for the head of this cabbage ſhould never be taken off †: and our reaſon tells us that the horſe-hoeing huſbandry will beſt ſupply it with a ſufficiency of food, in a fine, deep, and well looſened ſoil.

Mr. Miller adviſes [c] as the beſt method to ſave the ſeeds of all ſorts of cabbages, (of which there are very many kinds, chiefly cultivated for the table), to ſingle out the fineſt plants, to dig theſe up about the end of November, then to carry them to a ſhed, or other covered place, to hang them up there by their ſtalks for three or four days, that the wet may drain from between their leaves, and then to re-plant them, in a border of fine well looſened mould, under a hedge or pale, ſo deep as to leave only the upper part of the cabbage itſelf above ground; and even this ſhould be earthed up almoſt to it's very top, unleſs the earth be wet. In this caſe, indeed, the whole head of the cabbage ſhould ſtand pretty much above the ſurface of the ground, for fear of it's rotting.

If the winter ſhould prove very hard, a little ſtraw, or peas-haulm, ſhould be ſpread lightly upon theſe cabbages, to ſecure them from the froſt: but it muſt be removed as often as the weather proves mild, leſt they ſhould rot by being kept

† The head of the common curled borecole, or colewort, may be cut off in the winter, without any danger; and it's ſtem, if left ſtanding in the ground, will put forth fine lateral ſhoots in the ſpring, fit for the feeding either of men or cattle, or for being left to run to ſeed.

[c] *Ubi ſupra*

too cloſe. In the ſpring of the year, theſe cabbages will ſhoot out ſtrongly, and divide into a great number of ſmall branches, the principal of which muſt then be ſupported, either with props, or rather by being tied up to ſticks, to prevent their being broken off by the wind: and if the weather ſhould be very hot and dry when they are in flower, they ſhould be refreſhed with water once a week all over their branches; for this will greatly promote their ſeeding, and preſerve them from mildew.

When the pods begin to turn brown, it will be right to cut off the top of every ſhoot, with the pods thereon; for this will ſtrengthen the remaining ſeeds: and indeed it has been obſerved, that the very uppermoſt pods never contain ſo good ſeeds as thoſe which grow lower. When the ſeeds begin to ripen, great care muſt be taken that the birds do not deſtroy them, for they are extremely fond of this food. To prevent their depredations, ſome throw nets over their ſeeds: but this will not always do; for unleſs they are very ſtrong, the feathered tribe will force their way through them, as Mr. Miller ſays he has often ſeen, when old nets have been uſed for this purpoſe. He therefore prefers bird-lime, dawbed over a parcel of ſlender twigs faſtened at each end to ſtronger ſticks, placed in various poſitions near the upper parts of the ſeed branches, ſo that the birds may alight upon them, and be faſtened thereto: adding, that he has experienced, that when two or three birds are thus caught, and let remain there a conſiderable time, if they cannot extricate themſelves; this will ſo terrify the reſt, that they will not come to that place again, for a long while.

When the ſeeds are fully ripe, they muſt be cut off, dried, threſhed out of their pods, and laid up in bags for uſe.

The

The *Napus ſylveſtris*, or wild navew, commonly known by the name of rape, or cole, is much cultivated in the iſle of Ely, and in ſome other parts of England, for it's ſeed, from which the rape oil is drawn; and it hath alſo been very advantageouſly cultivated, of late years, in other places, for feeding of cattle. When it is intended for this purpoſe, it ſhould be ſown about the middle of June, on ground prepared as for turneps, that is to ſay, in very fine tilth. The quantity of ſeeds for an acre of land is from ſix to eight pounds: but as they are not dear, it may be beſt to allow eight pounds, becauſe it will be eaſy to thin the plants wherever they are too cloſe, when the ground is hoed. This ſhould be done as ſoon as they have put out about half a dozen leaves, in the ſame manner as is practiſed for turneps, with the difference only of leaving theſe plants much nearer together: for as they have fibrous roots, and ſlender ſtalks, they do not require near ſo much room. A ſecond hoeing, well performed, in dry weather, about five or ſix weeks after the firſt, will be all the culture that theſe plants will want. They will be large enough for feeding by the middle of November, when, if there be a ſcarcity of other fodder, this may be cut: but if there is not an immediate want of food, it had better be kept as a reſerve for hard weather, or ſpring feed, when there may be a ſcarcity of other green food. If the heads of theſe plants are cut off, they will ſhoot again early in the ſpring, and produce a good ſecond crop in April, which may be either uſed for cattle, or let run to ſeed, as is the practice where this plant is cultivated for it's ſeeds. It is ſo hardy as not to be deſtroyed by froſt, and therefore is of great ſervice in hard winters, for feeding of ewes: for when the ground is ſo hard frozen that turneps cannot be taken up,

theſe plants may be cut for a conſtant ſupply. Mr. Miller, ſays he has found, in ſeveral places where he has ſowed this ſeed, that one acre of land thus planted will produce almoſt as much food as two acres of turneps; that this will afford late food after the turneps are run to ſeed; and that, if it is permitted to ſtand for ſeed, one acre will produce as much as, at a moderate computation, will ſell for five pounds, clear of charges [b].

Partridges, pheaſants, turkeys, and moſt other fowls, are ſo fond of theſe plants, that, if there be any of them in the neighbourhood of the field where they are cultivated, they will flock thither, and lye conſtantly among them [c].

Experiments on Cabbages cultivated according to the New Huſbandry.

M. De Chateauvieux, intent upon trying whether all kinds of pot herbs may not be raiſed by the new husbandry, cheaper, more eaſily, and even better, without dung, than they are in the common way with a great deal of that manure; extended, in the following manner, the experiments of which a part has been already given *.

On the 25th of September, 1751, having ſingled out a ſpot of ground which had not been dunged at all for ſeveral years, but which had been thoroughly plowed the year before, when one half of it bore barley, and the other oats; he plowed in it, exactly as if it had been intended for wheat, a bed 160 feet long, and ſix feet ſeven inches wide, and planted on it a ſingle row of white cabbages, which were then watered, to make them

[b] *Gardener's Dict.* Art. BRASSICA. [c] *Ibid.*

* *Viz.* on carrots, *p.* 175; on beet roots, *p.* 176; and on ſkirrets, *p.* 178.

take

take root the better[d]. The middle of this bed, which was it's higheſt part, was exactly over the intermediate furrow of the preceding year.

That he might be the better able to make a juſt compariſon between the cabbages of this bed, and thoſe of his kitchen garden, he planted a ſpot of ground in this laſt place, the ſame day, with the ſame ſort of plants. This ſpot had been extremely well dug, and plentifully dunged by his gardener, who took all poſſible care of theſe plants, and weeded and watered them as often as was neceſſary: but inſtead of cabbaging, moſt of them ran up in height: upon which they were plucked up, and others were planted in their ſtead.

The row of cabbages in the undunged bed had juſt the ſame culture as would have been given to wheat.

On the 9th of March, 1752, the firſt ſtirring of the ground was performed with the plough. On the 25th of April, the ſecond ſtirring was given with the cultivator. On the 3d of June, the third ſtirring was performed with the plough; and laſtly, on the 20th of July, the plants were hoed by hand, for fear of hurting ſeveral ſtalks of wheat which grew on the next adjacent bed, and which were bent, but not lodged, ſo as to incline over the furrow of ſeparation.

Theſe cabbages were never watered after the time of planting them, and then only once: and yet they were always criſp and firm, even in the hotteſt days. By this eaſy and expeditious culture, they obtained all the perfection that could be wiſhed, and ſurpaſſed thoſe of the kitchen garden, as much in goodneſs, as they did in ſize. Moſt of them weighed between 15 and 18 pounds, and

[h] DUHAMEL, *Culture des Terres, Tom.* II. *part* 3, *c.* 1. *p.* 334.

the ſmaller between 8 and 10. The whole crop of this bed weighed upwards of 840 pounds.

In 1753, M. de Chateauvieux repeated his experiments on the ſame plants, *viz.* carrots, beet roots, ſkirrets, and cabbages; and all of them were as fine, and well flavoured, as before.

The ſame culture of the ſame plants anſwered equally well in the years, 1754, 1755, and 1756. They were, in every reſpect, much finer than thoſe of the kitchen garden; and, which is a very important proof of the excellency of the new huſbandry, in that it conſtantly preſerves a due degree of moiſture in the earth; nothing could be more ſtriking, than, in 1754 and 1755, which were very hot and dry years, to ſee theſe plants, always green, and in great vigour, thrive without any alteration; while thoſe in the kitchen garden, which were watered every day, drooped during part of the day, and grew but very ſlowly.

Another of M. Duhamel's correſpondents writes to this effect[c]. "My pot-herbs in beds (cultivated with the horſe-hoe) are the admiration of all "who ſee them. I have cabbages which, I dare "ſay, will weigh upwards of 45 pounds a-piece. "I had ſome laſt year, which weighed 35 pounds; "and the ground was not ſo well cultivated then, "as it is now, nor were they ſo early. They have "not ſuffered at all from the drought; but, on "the contrary, the warmer the weather has been, "the finer they have grown. They have not "been watered at all; nor have my carrots; and "I have cabbage lettuces which weigh five pounds. "One great advantage which I find in the new "huſbandry, is that the plants are preſerved from "the danger of two much rain, or too much "drought. The earth, when well cultivated, is

[c] *Culture des Terres, Tom.* III. *p.*43.

"always

"always in a moiſt ſtate. The more I reflect on "this new method of culture, the more I admire "it. None but thoſe who are thorough judges "of agriculture, can foreſee the immenſe advan-"tages which will hereafter attend it."

At the rate 840 pounds of cabbages on a bed 160 feet long and 6½ feet wide, an acre will yield nearly 35,280 pounds. If we eſtimate their weight only 35 pounds each, as in the foregoing experiment, inſtead of 15 or 18 pounds according to M. de Chateauvieux's, the produce of an acre will then be at leaſt doubled. Or if we ſuppoſe that cabbages can be raiſed in great perfection in beds four feet wide, the produce of an acre, on the footing of M. de Chateauvieu's eſtimate, will be 55,000 pounds. I do not know that it has yet been aſcertained by experiment, how much cabbage a bullock can eat in a day: but, that I may be ſure to allow him enough, I will ſuppoſe it to be half as much again as he can eat of turneps, that is to ſay 300 pounds of cabbages, which are a leſs ſubſtantial food. Now even at this allowance, in which the animal is ſurely not ſtinted, the above produce of an acre of land; ſuppoſing it to be but 35,280 pounds of cabbages, will feed a bullock during four months.

The cakes of the rape or cole ſeed are great fatteners of cattle, and ſo are the cakes of lin-ſeed, after their oil has been extracted: but they are apt to render their fat yellow and rank. To remedy this, they ſhould be feed with dry fodder, for a fortnight or three weeks before they are killed.

I have already mentioned theſe cakes as an excellent manure for land: but I believe they will turn to greater profit when uſed for the food of cattle.

ARTICLE II.

Of Clover.

THERE are many ſpecies of this plant; but the ſorts generally cultivated in the field, for the food of cattle, are, the red or Dutch clover (*Trifolium purpureum majus, pratenſi ſimile*, Ray. Syn. 328); the white meadow trefoil, honey ſuckle graſs, or white Dutch clover (*Trifolium pratenſe album*, C. B. P. 327); and the yellow meadow trefoil, or hop clover (*Trifolium pratenſe luteum, capitulo lupuli, vel agrarium*, C. B. P.

The red clover, too well known to need any particular deſcription *, is a biennial plant, whoſe roots decay after they have produced ſeeds: but if the plants are eaten down, or mowed, when they begin to flower, they will ſprout out anew, and by that means continue longer than they would otherwiſe. The uſual allowance of ſeed

* To diſtinguiſh it from the red meadow trefoil, with which Botaniſts have frequently confounded it, on a ſuppoſition of their being the ſame ſpecies, Mr. Miller obſerves, that he has often ſown the ſeeds of both in the ſame bed, and that they have conſtantly produced their reſpective ſpecies, without varying. The ſtalks of the meadow trefoil are weak and hairy, the ſtipulæ which embrace the footſtalks of the leaves are narrow and very hairy; the heads of the flowers are rounder than, and not ſo hairy as, thoſe of the clover, whoſe ſtalks are ſtrong, almoſt ſmooth, furrowed, and riſe twice the height of the other. The heads of the flowers of the meadow trefoil are larger, more oval, and more hairy, than thoſe of clover; their petals open much wider, and their tubes are ſhorter. But the clover has been ſo much cultivated in England for near a hundred years paſt, that it's ſeeds have been ſcattered over moſt of our paſtures, ſo that there are few of them which have not clover mixed with the other graſſes; and this has often deceived botaniſts, who have ſuppoſed that the meadow trefoil has been improved to this, by dreſſing of the land. *Gardener's Dict.* Art. Trifolium.

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for an acre of ground, in the common huſbandry, is ten pounds. In the choice of the ſeed, that which is of a bright yellow colour, inclining to brown, ſhould be preferred; and the pale coloured thin ſeed ſhould be rejected.

The general cuſtom in England is, to ſow this clover with barley, in the ſpring: and when the barley is taken off the ground, the clover ſpreads and covers it, and remains two years: after which the land is plowed again for corn, and is thought to be greatly enriched by the clover. The clover ſeed ſhould not be ſown, till after the barley has been harrowed in; for otherwiſe it would be buried too deep: and after it is ſown, the ground ſhould be rolled to preſs the ſeeds into it: but this ſhould be done in dry weather, becauſe moiſture will often make the ſeeds burſt, and when the ground is wet they will ſtick to the roller, and the ſurface of the ſoil will be ſo hardened by the rolling, that numbers of plants will fail, for want of being able to pierce through it. This is the general method, when clover is ſown with corn. But it would be much better always to ſow it alone; for then the plants come on much faſter, and are not choaked, for one whole ſeaſon, as they frequently are in the other way, when the crop of corn is great.

Mr. Miller, after many years trial, adviſes therefore to ſow the ſeeds of clover in Auguſt, when there is a proſpect of rain ſoon after: becauſe the ground being then warm, the firſt ſhower of rain will bring up the plants, and they will have time enough to get ſtrength before the winter; and a good rolling in October, when the ground is dry, will preſs it cloſe to the roots, and make the plants ſend out more ſhoots: and this he adviſes repeating again in March. The reaſon of his preferring this ſeaſon for ſowing clover, rather than the ſpring, is, becauſe the ground is cold and wet in the

ſpring

ſpring, and if much rain fall after the ſeeds are ſown, they will rot in the ground; and many times when the ſeed is ſown late in the ſpring, if the ſeaſon ſhould prove dry, the ſeeds will not grow.

The author of the new Syſtem of Agriculture, too apt, ſometimes, to be poſitive in his opinion, agrees with Mr. Miller, that it is beſt to ſow clover in the autumn, and always by itſelf, on land brought to the fineſt tilth poſſible, and cleared of all fibrous roots and other traſh, by going over it with fine toothed harrows: but he differs from him in regard to the quantity; the former ſtrongly recommending, never to ſow leſs than twenty pounds upon an acre.

"Many, ſays he [f], will object againſt this, be-
"cauſe they never knew any man ſow above half
"that quantity. — I anſwer, they never knew
"any man who reaped half the profit which he
"might have done by it, if he had followed my di-
"rections.— It is obſervable, that there are more
"ignorant men who profeſs huſbandry, than of
"any other art; and yet fewer of this profeſſion,
"than any of the reſt, who think they can be
"taught. A man, not poſſeſſed of this temper,
"would eaſily imagine that the thicker this little
"ſeed is ſown, the thicker it will ſpring, and the
"better keep down all weeds, and common graſs,
"and, conſequently, become of double advan-
"tage *.

"Sowing

[f] *Page* 208.

* The ſmallneſs of a ſeed is certainly no rule to judge of the ſize of the plant, or of the ſpace moſt proper to be allowed for it to grow in. Nor can it be ſuppoſed, but that clover, as well as any other plant, may be ſown ſo thick that the whole crop will be thereby choaked, and hindered from growing; or at leaſt, from growing to the perfection it would otherwiſe attain. The very circumſtance of the ſmallneſs of the ſeeds is eſſentially

"Sowing clover in September, inſtead of the "ſpring, and ſowing it alone, has many conveni- "encies: it will riſe thick, and ſwarth the ground, "before the hard weather comes in; and thereby "not only gather ſtrength, to defend itſelf againſt "the winter froſts; but will be ſo early in the "ſpring, that you might mow it, the firſt time, "in the very beginning of May, or, perhaps, "ſooner.

"When the firſt hard froſts have bound the "earth ſo faſt that you may bring horſes upon it, "without damage to the roots of the clover, this "is the very point of time in which you ſhould "beſtow about eight or ten load of ſea-ouze, ſea- "ſand, ſheep's dung, or that of the ſtercorary, "upon every acre, taking care to ſpread it as "equally as may be, that, when the froſt diſſolves, "the rains may drive the ſtrength of the manure "into the earth, which, in the tender infancy of "the new turf, will eaſily admit it, to the nouriſh- "ment of the roots, and ſurpriſing increaſe of "your clover, both as to quantity and ſweet- "neſs."

Upon this difference of opinion with regard to the quantity of clover ſeed moſt proper to be ſown, Mr. Maxwell, who likewiſe is not infallible, reaſons thus [g].

"In an acre of land there are 160 ſquare perches of 16½ feet to the perch; and in five pounds of clover ſeed, there are 160 half ounces; which is half an ounce to the perch. In half an ounce of clover ſeed, if well choſen, there will be found

g *Miſcellaneous Papers on Huſbandry, p.* 46.

eſſentially to be conſidered in this, as in all other ſmall grains, in order to guard againſt the general, and fatal, error of ſowing too thick: for, as I have repeatedly obſerved, it is not the ſize or quantity of the ſeed, that is to be conſidered in ſowing; but the bulk and nature of the plant.

to

to be (after a trial made by water) about 8000 good ſeeds, which, if regularly ſown, may produce at leaſt 7000 good plants: whereas one ſquare perch cannot contain above 1156 plants at ſix inches equal diſtance. I think I am able to maintain, that plants of clover are ſufficiently near each other at ſix inches diſtance, conſidering how many ſtems each root ſends forth when ſtanding at due diſtances. I would now aſk, what comes of all the plants that ariſe from twenty pounds ſown on an acre. The anſwer appears plain. They rob and ſtarve one another, and are of very little value in compariſon of what they would be if there was more ſpace of ground betwixt them: juſt as it happens when a ſower loſes by accident ſome handfuls of corn, which falling thicker than reaſonable, the produce is of ſmall value, both with reſpect to ears and ſtraw, when all that is ſown at a due diſtance makes a valuable crop in both reſpects. This is confirmed by experience: for I have cut clover ſown with twenty pounds to the acre, and with five pounds to the acre. That ſown with five pounds produced the ſtrongeſt and beſt crop, though the ground on which both grew was in equal good heart, the ſame ſoil, and prepared in the ſame manner. A worthy member of our (the Edinburgh) Society has made the experiment, and will bear witneſs that it anſwered to ſatisfaction.

"In ſupport of my opinion [h], I incline to mention an experiment of Mr. Tull's, in a ſimilar caſe, in his own words. "I ſaw, ſays he, the "produce of two ſainfoin plants carefully weigh-"ed. They both grew on the ſame ground, not "far aſunder, and were of the ſame age, *viz.* "ſeven years. The one ſtood ſingle, and it's pro-

[h] *Ibid. p.* 48.

duce

" duce weighed thirty ſeven ounces and a half. " The other grew in a bunch among many neigh- " bours, and was dug up; and it's produce, cut " cloſe to the root, weighed three grains; which " is about a five thouſandth part of the other. I " think this proves that it is not extravagant to " ſay, one ſingle, or thin, Sainfoin plant may pro- " duce as much graſs or hay, as a thouſand thick " ones: but I have ſeen much greater ſainfoin " plants than this."

" As clover ſeeds are liable to be ſcorched and killed, if ſown in very hot weather, for their ſmallneſs is ſuch that they ſhould be but barely covered; I would, to prevent this as much as poſſible, adviſe ſteeping them before they are ſown, and drying them with chalk finely powdered, which will alſo conduce to their being ſown the more equally, as their whiteneſs then will render them the more diſcernable."

Experience ſhews, that very ſhallow ſowing of clover ſeed is neceſſary in this country. But the reverend Dr. Eliot, in whom mankind has lately loſt an univerſally beneficient friend, and America now laments the death of her doctor Hales, found, likewiſe by experience, that it grows beſt in the province of Connecticut, of which he was a ſhining ornament, when it has been ſown at full furrow depth, and that ſhallow ſowing of it there is attended with certain loſs, if a dry ſeaſon comes on ſoon after; whereas this danger is prevented by ſowing deep [h]. The very great heat in that inland part of the continent, may, in ſome meaſure, account for this wide deviation from what is known to be the right practice here.

About the middle of May, this graſs will be fit to cut; when particular care ſhould be taken in

[h] *Eſſays on Field Huſbandry, p.* 125.

making

making it into hay; for it will require a great deal more labour, and time, to dry, than common graſs, and will ſhrink into leſs compaſs: but if it be not too rank, it will make excellent food for cattle. The time for cutting it is when it begins to flower; for if it ſtands much longer, the lower part of the ſtems, and the under leaves, will turn yellow, and theſe laſt will fall off, and conſequently the quantity of the hay will then be leſs, and not ſo well flavoured. Care ſhould likewiſe be taken not to ſtack it till it be thoroughly dry, for fear of it's heating.

One acre of this plant will feed as many cattle as four or five acres of common graſs: but they muſt not be ſuffered to eat too plentifully of it at firſt, leſt it burſt them. It ſhould be given them by degrees, till they are fully ſeaſoned to it: nor ſhould they ever be turned into this food in wet weather. Some ſow rye graſs among their clover, and let them grow together, in order to prevent the ill conſequences of the cattle feeding only on clover: but in this they are to blame; becauſe the rye graſs does great injury to the clover; for, riſing earlier in the ſpring, it covers and cripples the young clover; and beſides, it is obſerved to exhauſt the land, as well as to bind the ſurface of it by it's numerous creeping horizontal roots. However, it is yet a queſtion with farmers, whether the additional weight of graſs which the rye-graſs yields, does not counterbalance theſe diſadvantages.

This plant is reckoned much better fodder for moſt other cattle, than for milch cows; wherefore theſe ſhould ſeldom have any of it: though when it is dry, it is not near ſo hurtful to any ſort of cattle, as when green.

When the ſeeds of clover are deſigned to be ſaved, the firſt crop in the ſpring ſhould be let ſtand

ſtand till they are ripe, which is known by the ſtalks and heads changing to a brown colour: and then it ſhould be cut in fair weather, and be well dried before it is laid up; for otherwiſe the ſeeds will not eaſily quit their huſks, when it is threſhed. To this is owing a common complaint of farmers, that they often times cannot threſh out their clover ſeed without great labour and difficulty. But it will generally be found in this caſe, that theſe are ſecond crops, which ripen late in autumn, when there is not heat enough to dry the huſks ſufficiently to make them part eaſily from the ſeed.

To remedy this inconvenience, the juſtly regretted Dr. Eliot propoſes the following, as the moſt effectual and expeditious way of cleanſing this ſeed.

"Take, ſays he, your clover hay to a tanner's "bark-mill, where they uſe a ſtone-wheel, grind "it, and clear it from the chaff with a corn-fan: "what heads or chaff are not fully cleared, and "all the ſeed got out, put upon the floor and "grind again, and fan it as before. In this man-"ner, I am told a man will quite clean a buſhel "in one day: nor will the ſtone wheel cruſh and "ſpoil any of the ſeed; a miſchief which, at firſt, "one would think unavoidable. Where a ſtone "wheel cannot be had, it may be worth while "to try a cyder-mill: but I fear there will want "the roughneſs of the ſtone to tear off the chaff."

Mr. Maxwell thinks[i] that clover is benefited by being ſown with barley or oats, becauſe, being weak and tender the firſt year, it would be overcome by weeds, which would grow in great numbers, if not kept down by a crop of corn, the ſtems of which, being at a ſufficient diſtance to admit the

h *Eſſays on Field Husbandry*, p. 30. i *Miſcellaneous Papers on Husbandry*, p. 18.

air to the clover, will at the ſame time alſo protect it from drought. The ſtubble proves a farther protection, after the corn is cut down; and when it rots, it manures the ground.

But he is againſt ſowing rye-graſs with it; becauſe gramineous plants are impoveriſhers of land, while the leguminous enrich it: as a proof of which he inſtances a field which was ſown with rye graſs and clover, but in ſowing the rye graſs, one ridge happened to be miſſed. This ridge, after the firſt year, had much finer clover, and when the ground was plowed up it bore far better corn, than the reſt of the field.

Mr. Tull, on the contrary, diſapproves of ſowing clover, but particularly the broad leaved ſort, with barley, of which, he ſays [k], he has known a crop be damaged by it, in a wet ſummer, to the value of four pounds an acre. However, he obſerves that this may be prevented, by drilling the clover after the barley is a hand high, or more: for then the barley will keep it under, and not ſuffer it to grow to any conſiderable ſize till after harveſt: nor will the drill hurt the barley, if it be drawn by hand.

"In a dry ſummer, continues Mr. Tull, extolling the ſuperior worth of ſainfoin, both the broad leaved and the hop clover are apt to miſs growing; and if the broad leaved does grow, and the next ſummer (when it ought to be a crop) prove very dry, it fails on moſt ſorts of land, though it was vigorous enough to ſpoil the barley the year it was ſown. At beſt it is of but very ſhort duration, and therefore is not to be depended on by the farmer, for maintaining his cattle, which the broad clover will alſo kill, ſometimes by cauſing them to ſwell, unleſs

[k] *Horſe-hoeing Huſbandry*, p. 188.

"great

"great care be taken to prevent their eating too "much of it whilſt it is green. The broad clover "is eſteemed a foul feed for horſes, and the hop "clover is gone out of the ground ſooner than "the broad clover: I never knew it cut more "than once. Indeed cattle are never ſwollen by "feeding on it; but then it affords but very little "feeding for them, except the land whereon it "grows be very rich."

No conſideration whatever ſhould induce the farmer to let his clover ſtand more than two years. He ſhould then, at the very lateſt, plow it up. But I would recommend, as a much better practice, and that which is followed by the beſt huſbandmen, to take only one crop of the firſt year, and to plow down the ſecond crop, to prepare the land for wheat.

When the clover grows very luxuriantly, ſome are tempted to continue it another year; and in that caſe they frequently let the ſecond crop run to ſeed; or at leaſt ſuch part of it as may be ſufficient to anſwer the exigencies of the farm. But, in this caſe, as all plants which run to ſeed impoveriſh the ground greatly; the land on which the clover has ſeeded ſhould be laid up rough during the winter, to prepare it for a ſpring crop. Barley and oats are the only crops with which it ſhould be ſown: but barley is the beſt.

If clover has ſtood three years, a rich crop of wheat cannot poſſibly be had next after it, without loſing a crop of ſome other grain, by a ſummer fallow; becauſe the ground, though in the very fineſt tilth when the barley was ſown, for ſuch it ought to be both for that grain and for this plant, will by that time be grown hard and ſtiff, and bound with the roots of graſs and weeds, which will have prevailed as the clover died away. To

prevent this inconvenience, the clover ſhould, as before adviſed, be plowed up after one crop.

Mr. Liſle, after obſerving that broad clover runs ſooner to graſs when fed, than when mowed, and that the firſt year's clover makes the beſt early graſs for horſes *; inſtances, however, from his own experience, the advantage of the ſecond year's growth of broad clover, for feeding cattle in the ſpring. He tells us [n], that in the year 1719, his great cattle muſt have ſtarved, had it not been for this relief, which ſupported them from the middle of April to the middle of May, nearly as well as the firſt crop of the ſame plant had done, the former year, in July and Auguſt: for that his fodder-ſtraw being gone by the middle of April, and no rain having fallen for five weeks before, ſo that there was no graſs of any other kind, the after-growth of twenty acres of this clover maintained, during the above time, twenty-three yearlings, and eight ſteers of four years growth, beſides a great many hogs; and yet the paſture grew, and run more and more to a head every day, though ſheep had fed it down bare early in the ſpring, and the ground was not ſhut up till the beginning of April, when a north-eaſt wind, which had blown for a long time, and the drought, ſtill continued to oppoſe the growth of all graſs.

It cannot be doubted, that all ſorts of clover would grow much larger and ſtronger if ſown in drills and hoed between the rows, than it does in the common broad-caſt way; though it is a queſtion with M. Duhamel [o], whether it be not too ſhort lived, properly to admit of this method. In

* The ſecond crop of all graſſes is leſs valuable than the firſt.

[n] *Obſervations in Husbandry, Vol.* II. *p.* 44.

[o] *Eléments d'Agriculture, Tom.* II. *Liv.* 9. *c.* 2.

his

his treatiſe on the culture of land, he gives us the following experiment on this plant [p].

M. de Pontbriant, of Rennes in Britany, ſowed about half an acre of land with flax and hemp, mixed with clover ſeed. As ſoon as the former were plucked up, the clover appeared, and grew ſo well that it was cut in November of the ſame year. It was weeded in February, and mowed again in the beginning of May. As it was too thick, he made alleys in it a foot wide. Theſe alleys furniſhed him with plants enough to ſtock upwards of an acre and a half of other land, where they were ſet a foot and a half aſunder, which is a ſufficient ſpace for hoeing, and they throve admirably well.

The French have their clover ſeed from Flanders, Italy, and their own province of Burgundy.

To guard againſt the inſect (be it fly or worm) which ſometimes eats the clover ſeed in the ground, the author of the new Syſtem of Agriculture adviſes [q] ſteeping it, for the ſpace of a night, in ſoot, and as much urine, as will make it liquid. How far this may really anſwer, I know not; but he ſeems to recommend it very confidently.

The white clover, generally known among farmers by the name of white honey ſuckle, is a laſting plant, and therefore belongs properly to the ſubject of permanent paſtures, under which it will accordingly be treated of; as will alſo the ſeveral ſorts of meadow trefoil.

[p] *Tom.* III. *p.* 419. [q] *p.* 208.

CHAP. II.

Of perennial Plants uſed for the food of Cattle, and which require frequent help while they grow.

HAVING reſtricted myſelf, in the preceding chapter, to the culture of ſuch vegetables as are, or may be, ſown interchangeably with crops of corn, for the food of cattle; I am now to ſpeak of thoſe other plants uſed for paſture, which, though perennial, require more care and attention than is commonly beſtowed on graſſes. Of theſe, Sainfoin and Lucerne are the chief: and, if we may judge by the ſucceſs he has hitherto met with, the world will be greatly indebted to Mr. Rocque of Walham Green, for his particular culture of Burnet, which being a native of this country, and remarkably hardy, promiſes conſiderable advantages.

ARTICLE I.

Of Sainfoin

THE French call this plant *Sainfoin*; *ſain*, in their language, ſignifying wholeſome, and *foin* hay; becauſe it is obſerved to agree extremely well with all ſorts of cattle. Our writers on huſbandry are apt, improperly, to call it *ſaint foyn*, and frequently *French graſs*; becauſe we owe our firſt knowledge of it to the French. It's Latin name is *Onobrychis*.

If Sainfoin is cultivated according to the new huſbandry, it's ſtalks will grow five feet long; and, according to Mr. Tull [a], one acre of it will

[a] *Horſe-hoeing Huſbandry*, c. 12.

yield

yield as much graſs as 30 or 40 acres of common paſture.

This great fruitfulneſs of ſainfoin, is owing to the vaſt quantity of it's roots. It's tap-root pierces ſometimes fifteen or twenty feet deep into the earth, and ſends forth many lateral branches, which extend a great way, eſpecially towards the ſurface of a good ſoil.

It is wrong to think, as many do, that ſainfoin will not ſucceed if there is not, at a certain depth, a bed of gravel, ſtone, or chalk, to ſtop the progreſs of it's roots. On the contrary, the deeper the earth is, the more it's roots extend, and the ſtronger and more flouriſhing is the plant.

As ſome of it's ſeed will frequently not grow, a ſmall quantity ſhould always be ſown firſt, to try it, as has been directed in regard to wheat, and other plants.

Sainfoin ought not to be ſown above half an inch deep, eſpecially in ſtiff lands: for the heads of it's ſeeds are ſo large, and their necks ſo weak, that if they lie much more than half an inch deep, they are not able to riſe through the incumbent mould.

As this plant yields but an inconſiderable produce the firſt year, the farmer, in order to make the more of his land, often ſows barley, oats, clover, &c. with it. The barley and oats remaining but a ſhort time on the earth, do no great injury to the ſainfoin: but clover, and other perennial plants, hurt it very much.

It frequently happens, in dry years, that no ſainfoin is ſeen when the barley or oats are mowed: but on examining nearly, we may generally perceive white threads, which ſhew that the ſainfoin has ſprouted, and that it's leaves, then very ſmall, have been cut off by the ſcythe.

If the other ſeeds ſown with the ſainfoin, come up thick, and grow a-pace, and eſpecially if they are lodged, the ſainfoin is generally choaked. But this ſeldom happens if it is ſown with the drill-plough: for as it is then planted by itſelf, in ſeparate rows, it is leſs in danger of being over-powered by any other plants. It certainly does beſt when ſown quite alone.

When Mr. Tull began to cultivate ſainfoin with the horſe-hoe, he ſowed two gallons of ſeed to an acre, and almoſt all the ſeed of an acre or two of ground periſhed, through it's being ſown too late. But he was agreeably ſurprized at the end of three years, to ſee ſome plants of this herb, of an extraordinary ſize, diſperſed here and there, in ſuch manner that there were about four plants in a yard ſquare. This part of his field yielded him double the quantity of graſs that the reſt of it did, where the ſeed had not periſhed, and where the ſainfoin was much better than in lands which had been ſown in the common way.

He concludes from thence, that it is moſt profitable to ſow ſainfoin thin, that the roots of one plant may not hurt thoſe of another: and he thinks that they deceive themſelves who ſow their ſainfoin very thick in hopes of reaping a more plentiful crop; becauſe, by ſo doing, they reduce their ſainfoin to the condition it is in on the hills of Calabria, near Croto, where it grows naturally, without any culture, but ſo low and ſtinted, that one would almoſt wonder what could induce any one to think of cultivating ſo unpromiſing a plant as it there ſeems to be.

Mr. Tull ſupports his opinion by an obſervation which it may not be improper to mention. He ſays, that a field of ſainfoin adjoining to a piece of land which he had ordered to be plowed up for corn, was greatly damaged by the plough, which

which, breaking in upon the ſainfoin, tore up ſeveral plants: but that this part of the field yielded afterwards more graſs than other.

He thinks a gallon of good ſeed enough for an acre of land. But this ſeed ſhould be ſo diſtributed, that all the plants may be at equal diſtances; which cannot be done but with the drill-plough. There is no fear of diminiſhing the crop, by leſſening the number of the plants, for one plant well cultivated will yield above half a pound of hay; and conſequently, if only 112 plants grow upon a ſquare perch, and yield one with another only a quarter of a pound each, they will produce after the rate of two tons to an acre. One would not expect ſo conſiderable a return while the plants are yet ſmall and young, before they cover the ground, and while the field looks as if the greateſt part of it lay waſte: but when they have attained their full growth, they cover the whole ſurface. Another advantage ariſing from the new huſbandry is, that if the ſainfoin has been ſown early, it yields a crop the ſecond year, in this way, equal to the third year's crop of that which is ſown according to the common method.

Mr. Tull [b] draws theſe concluſions from his experiments.

1. When ſainfoin is ſown with a deſign to cultivate it with the horſe-hoe, the beſt way is to ſow it in two parallel rows, eight inches diſtant from each other, and to make the alleys forty inches wide; ſo that from the middle of one furrow, to the middle of another, ſhall be four feet.

2. If ſainfoin is ſown with an intention only to hand-hoe it, the ſpace between the rows ſhould be ſixteen inches, and the plants in the rows ſhould be at leaſt eight inches aſunder.

b *Ubi ſupra.*

3. When

3. When ſainfoin is ſown without any deſign to hoe it, the beſt way is to drill the rows eight inches aſunder, with no greater quantity of ſeed than when they are at ſixteen inches diſtance: for each plant ought to have a ſufficient ſpace around it, to extend it's roots in, and draw it's neceſſary nouriſhment from, without hurting it's neighbouring plants.

Sainfoin thrives beſt in a rich, dry, and light ſoil, eſpecially if there is a bed of lime, chalk, or gravel, under a conſiderable depth of mould. In marſhy grounds, or in lands which retain water, the roots are chilled, and the plant ſoon periſhes. Though it is a ſtrong plant, the ground on which it is ſowed ought to be in very fine tilth: for as it ſhoots out a great number of roots the moment it ſprouts, the mould ought to be looſe, and the ſtaple as deep as poſſible. It may be ſown at any time: but if ſo late as autumn, the young plants will be in danger of being hurt by froſts: and if it is ſown in ſummer, the ſeed frequently remains long in the earth without ſprouting; or if it riſes, the drought, uſual at that ſeaſon, ſtints the young plants. The ſpring is therefore the moſt proper ſeaſon for ſowing it, when there is no longer any danger of hard froſts.

By means of the drill-plough, the ſeed of the ſainfoin is dropt into channels which this inſtrument makes, and is at the ſame time covered with the proper depth of earth.

It will not be neceſſary to horſe-hoe the alleys between the beds of ſainfoin, ſo often as between thoſe of corn. Once a year will be ſufficient for the alternate alleys: ſo that one half of them will be reſted yearly, and the hay may be made thereon. By this means the expence will be but trifling, and the ſainfoin may laſt thirty years on the ſame ground, which, by this frequent ſtirring,

will

will be the better prepared afterwards to receive grain.

Sainfoin deſerves the farmer's utmoſt attention, as one of the moſt profitable plants he can cultivate. It will do on almoſt any land; and though it ſucceeds beſt in good ſoils, yet it will grow even on dry barren ſpots, where ſcarce any other graſs can live; provided it's roots be not chilled by a cold clay, or other ſubſtance which retains water: and it has this farther advantage, that it may be mowed at different degrees of ripeneſs, with nearly the ſame profit[1].

1. It may be mowed before it is in bloom, for it is then admirable food for horned cattle; and when cut thus early, it yields a ſecond crop, which makes ample amends for what was loſt by not letting the firſt come to it's full growth. This early cutting is likewiſe attended with another benefit, which is, that it purges cattle, in the beginning of the ſummer, and thereby frees them from diſorders occaſioned by the winter's cold, or dry food.

2. If the weather be rainy, the ſainfoin may be left ſtanding till it is in bloom; when it ſtill is excellent fodder for cows. But care muſt be taken in making it into hay, that the flowers do not drop off, as they are very apt to do: for cattle are ſo fond of theſe flowers, that they often induce them to eat the reſt of the plant.

3. If the rain continues, the ſainfoin may be left ſtanding till ſome of it's ſeeds are formed, and the crop will then be the more plentiful; not only becauſe it will have attained it's full growth, but likewiſe becauſe it's leaves, being more ſubſtantial, diminiſh leſs in drying. It is not indeed, then, quite ſo ſweet as before; but horſes eat it

[1] DUHAMEL, *Culture des Terres, Tom* I. *c.* 19. *p.* 152.

readily,

readily, becauſe they love to feel between their teeth the ſeeds which now begin to be formed.

Mr. Tull ſays this fodder is ſo excellent, that horſes need no oats when they are fed with it. He affirms that he kept a team of horſes with it a whole year in good plight, without giving them any oats, though they were worked hard all the time. He adds, that he fattened ſheep with it, in leſs time than others which were fed with corn. But the hay of this plant can never be ſo good as when it is cultivated with the horſe-hoe: for in the common huſbandry, it bloſſoms almoſt as ſoon as it is out of the ground.

4. If the ſeaſon continues rainy, it may be more adviſeable to let the ſainfoin remain ſtanding, than to run the hazard of having it rot upon the ground: for then the ſeed will ripen, and nearly make up for the loſs of the fodder; not only becauſe it will fetch a good price, but alſo becauſe two buſhels of it will go as far in feeding of horſes, as three buſhels of oats; and cattle in general, as well as poultry, are extremely fond of it*.

Even the ſainfoin that has yielded it's ſeed, may be cut down and dried; and when other fodder is ſcarce, this will be better food for horſes and large cattle, than the coarſe hay of flowed meadows, or any kind of ſtraw.

* The firſt of theſe ſorts of ſainfoin hay, cut before the bloom, is Mr. Tull's *virgin* hay, which, he ſays †, is the beſt beyond compariſon, and has not it's equal, in the world, except lucerne. He gives the next place to the ſecond ſort, cut whilſt in bloom, and ſays that an acre of land, well cultivated, may yield three tons of this *bloſſomed* hay: and he eſteems the third ſort, which he calls the *full grown*, many degrees inferior to either of the former; though it yields a greater crop, becauſe it has grown to it's full bulk, and ſhrinks but little in drying.

† *Horſe-hoeing Huſbandry*, c. 12.

The

The manner of making ſainfoin hay is thus directed by M. Duhamel [s].

In a day or two after the ſainfoin has been mowed, it will be dry on the upper ſide, if the weather be good. The ſwarths, or mowed rows, ſhould then be turned, not ſingly, but two and two together: for by thus turning them in pairs, double the ſpace of ground is left betwixt pair and pair, and this needs but once raking; whereas, if the ſwarths were turned ſingly, that is, all the ſame way, the ground would require as much raking again.

As ſoon as both ſides of the ſwarths are a little dry, they ſhould be made up into ſmall cocks, the ſame day they are turned, if poſſible: for when the ſainfoin is in cock, a leſs part of it will be expoſed to the injuries of the night, than when it lies ſcattered upon the field. The ſun and dew would exhauſt almoſt all it's juices, in this laſt caſe, in leſs than a week's time.

Theſe little cocks of ſainfoin may be ſafely made into larger ones, without waiting for their being ſo thoroughly dry as thoſe of common hay ought to be before they are laid together: becauſe common hay, by ſinking down cloſer, excludes the air neceſſary for keeping it ſweet; ſo that if the weather prevents it's being frequently ſtirred and opened, it will heat, turn yellow, and be ſpoiled; whereas ſainfoin, by admitting the air more freely, becauſe it's ſtalks are leſs flexible, will remain much longer without any danger of fermenting.

Sainfoin hay is never better than when it has been dried by the wind only, without the aſſiſtance of the ſun. A little rain, or a miſt, which will turn common hay, clover, and even lucerne, black;

[s] *Ibid, p.* 263.

will

will do no hurt to ſainfoin, which is not really ſpoiled, till it rots upon the field.

If the weather threatens rain, and the ſainfoin is not yet dry, it may be laid in cocks, without fear of it's heating, provided a large baſket, or buſhy faggot, be ſet up in the middle of each cock, where it will ſerve for a vent hole, through which the ſuperfluous moiſture of the hay will tranſpire.

As ſoon as all danger of it's heating is over, theſe cocks ſhould be made into ricks, and thatched. That which is laid up quite dry, will come out of the rick of a green colour: that which has heated much in the rick, will look brown.

It requires ſome experience to know at what degree of ripeneſs it is beſt to cut the ſeeded ſainfoin; becauſe all it's ſeeds do not ripen at the ſame time. Some ears bloſſom before others; every ear begins bloſſoming at it's lower part, and continues to blow gradually upward, for many days; ſo that before the flower is gone off at the top, the ſeeds are almoſt filled at the bottom. By this means, if the cutting be deferred till the top ſeeds are quite ripe, the lower, which are the beſt, would ſhed, and be loſt. The beſt time, therefore, to cut it, is when the greateſt part of the ſeed is well filled, the firſt blown ripe, and the laſt blown beginning to be full. The unripe ſeeds will ripen after cutting, and be, in all reſpects, as good as thoſe that were ripe before. Some, for want of obſerving this, have ſuffered their ſainfoin ſeed to ſtand till all of it has ſhed, and been loſt in cutting.

Sainfoin ſhould never be cut in the heat of the day, while the ſun ſhines out; for then much, even of the unripe ſeed, will ſhed in mowing. The right time for this work, is the morning or the evening,

evening, when the dew has rendered the plants ſupple.

If the weather is fine and clear, the ſainfoin will ſoon dry ſufficiently in the ſwarths, without turning them: but if any rain has fallen, and there is a neceſſity for turning them, it ſhould be done very gently, while they are moiſt, and not two ſwarths together, as in the other hay made of ſainfoin before it has ſeeded. If the ſwarths are turned with the handle of the rake, it is beſt to raiſe up the ear-ſides firſt, and let the ſtub-ſide reſt on the ground in turning: but if it is done with the teeth of the rake, let the ſtub-ſide be lifted up, and the ears reſted on the earth.

If ſainfoin be cocked at all *, the ſooner it is done, the better; becauſe, if the ſwarths are dry, much of the ſeed will be loſt in ſeparating them; the ears being entangled together. When moiſt, the ſeed ſticks faſt in the ear; but when dry, it drops out with the leaſt touch or ſhaking.

There are two ways of threſhing it: the one in the field, the other in the barn. The firſt cannot be done but in very fine weather, and while the ſun ſhines in the middle of the day. The beſt manner of performing this, is to have a large ſheet pegged down to the ground, for two men to threſh on with their flails, while two others bring them freſh ſupplies in a ſmaller ſheet, and two more clear away the hay that has been threſhed. The ſeed is emptied out of the large ſheet, and riddled through a large ſieve, to ſeparate it from the chaff and broken ſtalks; after which it is put into ſacks and carried into the barn to be winnowed. Care

* Sometimes it is threſhed in the field, without being cocked; and in this caſe, the ſwarths are only juſt ſeparated, in the dew of the morning, into parcels of about two feet each; by which means it is ſooner dried, than when it lies thicker, as it muſt do, if made into cocks.

ſhould be taken not to let the hay get wet, becauſe it would then be ſpoiled.

A very important, and at the ſame time very difficult article, is the keeping of the ſeed that has been threſhed in the field, without having ever been wetted. If it be winnowed immediately, and only a little of it laid amidſt a great heap, or put into a ſack, it will ferment to ſuch a degree, in a few days, that the greateſt part of it will loſe it's vegetative quality. During that fermentation, it will be very hot, and ſmell ſour. Spreading it upon a barn floor, though but ſeven or eight inches thick, will anſwer no end, unleſs it be frequently and regularly turned both day and night, until the heating is over: but even this will not make it's colour keep ſo bright as that which is well houſed, well dried, and threſhed in the winter. This laſt, laid up unthreſhed, will keep without any danger of ſpoiling, becauſe it does not lie cloſe enough to heat. The beſt way to preſerve the ſeed threſhed in the field, is, to lay a layer of ſtraw upon a barn floor, and upon that a thin layer of ſeed, then another layer of ſtraw, and another layer of ſeed, and ſo on, alternately. By this means, the ſeed, mixing with the ſtraw, will be kept cool, and come out in the ſpring with as green a colour as when it was put in: or it may be preſerved in one of M. Duhamel's ventilating granaries.

The greateſt part of the ſainfoin that is ſown, is ſpoiled by being indiſcreetly fed by cattle. Mr. Tull is againſt feeding it at all during the firſt and ſecond year, or in the ſpring of any other year. He ſays he has recovered worn-out pieces of ſainfoin, by plowing them in alleys three feet wide, and leaving beds of ſainfoin of the ſame breadth alternately between them. The plants, by extending their roots in theſe new plowed alleys, have recovered their vigour, and yielded good crops of hay.

And

And he adds, that ſainfoin is obſerved to enrich whatever ground it is planted on, even though a crop be taken off it yearly.

This is confirmed by the author of the *New Syſtem of Agriculture*, who ſays [t]; "There is a foreign graſs much properer for light lands, than "clover: 'tis generally known by the name of "*St. Foine*; but that which I have ſeen in ſeveral "parts of Berkſhire, Wiltſhire, Somerſetſhire, and "many other counties, is a baſtard ſort, and much "inferior to the true *St. Foine* †, which may be "had, very reaſonably, from Dunkirk, or Calais, "and is yearly imported in great quantities, and "ſold in the ſeed-ſhops at London and elſewhere. "——As to the time of letting it grow, that may, "if you pleaſe, be five years, for ſo long it will "continue in it's prime perfection ‡; and, run-"ning into a large knotty root, does ſo enrich the "ground it grows on, that, after it has borne "*ſaint foyne* five years, it will afford three excellent "crops of what corn you pleaſe; and ſo improve

[t] p. 224.

† M. Duhamel, in his Elements of Agriculture[u], diſtinguiſhes three ſorts of ſainfoin; *viz.* the large ſort, which is that I have been ſpeaking of, and which is the beſt; a ſmaller ſort, with more prickly pods; and a large ſort which comes from Spain. This laſt bears very red flowers, and yields a great deal of fodder; but it cannot bear hard froſts.

‡ Though this author limits the prime perfection of ſainfoin to five years, in the common huſbandry; it will continue equally flouriſhing a much longer time, when cultivated according to the new method. However, M. Duhamel, who prefers this plant before clover, and even before lucerne, for the health of cattle, agrees with him, that, as ſainfoin will grow in almoſt any ſoil, and always enriches greatly that where it does grow, it is the farmer's intereſt not to continue it very long upon the ſame ground. Mr. Tull differs from M. Duhamel in allowing ſainfoin only the next place after lucerne[x].

[u] *Tom.* II. *Liv.* 9. *c.* 2. ART. 2.

[x] *Horſe-hoeing Huſbandry*, c. 12.

" itſelf, by alternate burthens of graſs and grain,
" till it arrives at the utmoſt perfection which land
" is capable of reaching.——Nothing is ſo ſweet,
" nothing ſo innocent, nothing ſo nouriſhing as
" this *ſaint foyne*; but, above all, it is obſerved to
" increaſe milk, in quantity, and quality, beyond
" any graſs yet known."

Experiments on Sainfoin.

IT is with ſingular pleaſure that I embrace this opportunity of giving the beſt and moſt judicious ſeries of experiments that I have yet been favoured with by any of my countrymen; and what adds greatly to my ſatisfaction on this occaſion, is, that they are communicated by a gentleman of diſtinguiſhed rank and fortune, in Yorkſhire, who, though he does not permit me to mention his name, is pleaſed to allow me to impart them to the public, for whoſe benefit he generouſly intends them. His patriotic ſpirit, and excellent inſtructions, will appear moſt conſpicuouſly in his own words, of which I ſhall therefore give a faithful tranſcript: in hopes that others may be thereby induced to emulate the noble example thus ſet them, of contributing to the real welfare of their country.—England has her Turbillys: but, unfortunately, they are unwilling to ſhew themſelves.

" From an entire conviction," ſays this *good Huſbandman* *, " that it is the duty of every ſub-
" ject to contribute all in his power to the good of
" ſociety; I have endeavoured, during ſeveral
" years that I have reſided in the country, to

* Majores noſtri, virum bonùm cum laudabant, ita laudabant, bonum agricolam, bonumque colonum. Ampliſſimè laudari exiſtimabatur, qui ita laudabatur.

CATO, de re ruſtica, lib. 1.

" pro-

" promote and encourage the advancement of " agriculture. To this end I have made variety " of experiments, on different ſoils, to prove and " aſcertain the moſt beneficial methods of huſ- " bandry, or how to employ land to the moſt ad- " vantage.

" A great part of my eſtate conſiſting of waſte " and uncultivated heath, which did not lett for " more than a ſhilling an acre, I judged it to be a " matter of importance to try if it was not poſſible, " by culture, or by applying this ground to a dif- " ferent purpoſe, to increaſe the value of it, " Happy would it be, could pleaſure be made to " coincide with profit! and it is certain, that who- " ever ſucceeds in the improvement of his own " eſtate, may enjoy the inward ſatisfaction of ren- " dering ſome ſervice to his country: for the ex- " ample of a landlord may be thought to have " ſome weight with his tenants; and if, amidſt a " great number of experiments made for the ſake " of truth, ſome have proved ſucceſsful, one may " expect that the farmer will at laſt adopt a me- " thod which he has for many years ſeen repeated " with advantage: for however the common far- " mer may have been accuſed of an obſtinate ad- " herence to old cuſtoms, many inſtances might " be produced of his quitting the paths of his " anceſtors in favour of modern improvements; " but then he muſt be throughly ſatisfied, that the " new way is indeed preferable to the old, not in " theory only, but in practice, confirmed by ac- " tual experiments often repeated before his eyes. " And can we juſtly blame the illiterate peaſant " for refuſing to forſake a method he is well ac- " quainted with, and can depend on for the ſup- " port of himſelf and family, upon other terms? " It is the province of the landlord to adopt a " theory, and to try it by experiment; for if it

" fails, as is often the caſe, his ruin is by no " means the conſequence, and the loſs is amply " made up to him, by the ſecret pleaſure always " accompanying a good intention. But whatever " ſervice a gentleman may be of in encouraging " reſearches of this nature, or by his influence in " his own neighbourhood; yet ought his benevo- " lence to extend farther, ſo as to be of uſe, if " poſſible, to his country and mankind. It is the " deſire of communicating the little knowledge I " may have gained from the experience of a few " years, that has prompted me to addreſs this " letter to you, who are engaged in an uſeful and " public undertaking: and you are at full liberty " to make uſe of it, together with the detail of " the experiments. They were begun without " the leaſt deſign of making them public, and " may therefore be deficient in point of method " and order: but they are ſtrictly true.

" On the 3d of April, 1759, two acres of very " ſandy land (which had 100 loads of red marle " laid on it the year before, and had borne a good " crop of oats in 1758) were drilled with ſainfoin, " on 4 feet ridges in double rows, 11 inch par- " titions, the intervals 3 feet 1 inch wide, and " took 4½ pecks of ſeed. This was intended to " be horſe-hoed, as Tull directs; but the land " was in ſuch bad tilth, and abounded ſo with " the natural graſs, that, after once or twice at- " tempting to deſtroy it, by plowing the intervals, " the horſe-hoeing ſcheme was given up, and the " ſainfoin left to take it's chance. However, a " few plants remained thinly ſcattered in the rows " (whether this thinneſs was owing to the badneſs " of the ſeed, or to it's being ſown too deep, I " know not, though I rather impute it to the lat- " ter cauſe, as, in ſandy land, the ſhares of the " drill are very apt to penetrate too far into the " ground.)

" ground.) Theſe remaining plants flouriſhed ex-
" ceedingly from the time of their being ſown;
" many were in flower the following June, and
" afforded a tolerable crop, *viz.* about a load.
" The after-eatage was very good. In 1760, theſe
" plants ſeemed to have arrived at their perfec-
" tion, and the product was two waggon loads,
" or about two tons. In 1761, and 1762, this
" ſmall cloſe, having had ſome manure laid on it
" yearly, yielded nearly the ſame quantity of hay;
" and it is now lett for 40 ſhillings a year: a much
" higher rent than any land is lett for in this neigh-
" bourhood, and four times the rent paid for it
" before the improvement.

" N. B. This cloſe of two acres was ſeparated
" from another of twenty-ſeven acres, of ſo ſandy
" and dry a nature, that, unleſs in a wet ſummer,
" the hay upon it was ſcarce ever worth mowing:
" and this experiment was made in order to deter-
" mine what improvement the adjoining large
" cloſe was capable of, and to experience whether
" or no the common opinion, that ſainfoin is im-
" proper for all ſandy and deep ſoils, be founded
" on truth, or only the reſult of prejudice: for
" the reaſon given for it's diſagreeing with this
" kind of ſoil, did not appear to me ſatisfactory;
" and great part of my eſtate conſiſting of ſuch
" ſandy land, it ſeemed a matter of importance,
" to know, whether the great advantage derived
" from ſainfoin, on ſome ſoils, might not alſo be
" applicable to ſandy ſoils.

" Encouraged by the flouriſhing condition of the
" ſainfoin on this ſmall cloſe, I determined to ex-
" tend the improvement to the larger one alſo, as
" ſoon as it could be brought into ſufficiently fine
" order to be laid down with this graſs. Ac-
" cordingly, in the winter of 1759, twenty-five
" acres were plowed with the five coultered

" plough, as recommended by M. Duhamel, in " his treatiſe on the cultivation of land, in order " thereby to prepare the ground for turneps the " enſuing ſummer: for I look upon this as one " of the beſt methods of deſtroying the natural " graſs, and preparing the land for any of the " artificial graſſes; eſpecially if the turneps are " drilled in rows, and cultivated with the horſe-" hoe. The land was plowed level in the ſpring " of 1760, and into ridges of about five feet " broad in June, and a ſingle row of turneps " was drilled on the middle of each ridge in July. " It is to be obſerved, that the natural graſs was " far from being deſtroyed by theſe three plow-" ings; nor could it be entirely ſo by the ſubſe-" quent hoeings of the turneps; ſo that it cer-" tainly was a great prejudice to the ſainfoin. " The ſame ground is now ſown again with the " ſame plant: but I would ſtrongly recommend " to thoſe who are inclined to follow this method " on ſuch a ſoil as I have deſcribed, to continue " the culture of turneps, with the horſe-hoe, two " years, inſtead of one: for by this means, the " natural graſs and weeds may probably be ef-" fectually deſtroyed. But to return to the ex-" periment: the turneps ſucceeded as well as could " be expected on ſuch a ſoil, and without ma-" nure: they were eaten off by ſheep, and Scotch " cattle, folded on the land.

" About four acres, on which the turneps were " the firſt ſpent, were plowed level, and after-" wards, *viz.* in November, drilled with ſainfoin " in equally diſtant rows, one foot aſunder. They " took about a buſhel to an acre. This was an " uncommon, and may be thought an improper " ſeaſon for the ſowing of ſainfoin: but I choſe " to ſow part of the field before winter, and part " in the ſpring, part with ſainfoin mixed with

" corn,

" corn, and part with ſainfoin alone; in order to " ſee which method would ſucceed beſt, that I " might make it my guide in other places, more " likely to yield good crops.

" Five or ſix acres of land were drilled in the " beginning of April 1761, with ſainfoin ſeed, in " rows, at the ſame diſtance, and with the ſame " proportion of ſeed, as the four acres ſpoken of " before: about three acres were ſowed ſoon after " with ſainfoin and oats, both drilled: and about " twelve acres were drilled with ſainfoin and bar- " ley; each in rows, about a foot aſunder. The " whole of this field, which contained twenty- " five acres, had been plowed but once ſince the " turneps; whereas two plowings might have " been better: but, on account of eating them " off with ſheep and cattle, there was not time " for it.

" The three acres ſowed with oats in rows a " foot aſunder, took four buſhels and a half of " ſeed, and produced a very good crop; by " computation, five quarters to an acre: but the " exact quantity, neither of the oats, nor of the " barley, could be known, on account of it's be- " ing mixed in the barn with corn that grew in " other places. The twelve acres ſowed with barley " took ſeventeen buſhels of ſeed, and produced " a much greater crop than any land in the neigh- " bourhood; though this was a great year for bar- " ley. All the farmers who obſerved this crop, " allowed that they had never ſeen finer barley; " and it may be ſaid, without the leaſt exaggera- " tion, to have yielded above five quarters to an " acre. I am convinced that this computation of " five quarters to an acre is a very moderate one; " not only from the number of ſheaves, and the " judgment of all who ſaw it; but likewiſe be- " cauſe I had no more than twenty-ſix acres and

" an half of land drilled with barley this year;
" and the whole produce, when threſhed, amount-
" ed to one hundred and twenty-eight quarters
" and two buſhels; which is very near five quarters
" to an acre, taking one part with another: but
" theſe twelve acres bore by much the greateſt
" crop in proportion, and ſeven acres of the twen-
" ty-ſix were ſown on beds five feet broad, and
" horſe-hoed, which never produces ſo large a
" crop.

" The ſummer of 1762 was remarkably dry and
" bad for graſs: many fields hereabouts, of ten
" acres, did not produce above a load or two of hay;
" but this of twenty-five acres produced twelve
" tons of good hay: which, conſidering that the
" ſainfoin was not nearly arrived at it's perfection,
" may be ſaid to be conſiderable.

" It was now eaſy to ſee in what parts of the
" field the ſainfoin had ſucceeded beſt.

" The four acres ſowed before winter had the
" ſmalleſt number of plants of ſainfoin of any;
" perhaps not more than one or two in ten yards:
" but this ground abounded ſo with natural graſs,
" that this alone furniſhed a tolerable crop. The
" five acres ſown in the ſpring, without corn, did
" not abound much leſs with natural graſs, or
" more with ſainfoin, than the preceding: but
" there being a great mixture of the ſeeds of rye-
" graſs with all the ſainfoin ſowed in this field, the
" rye-graſs appeared diſtinctly in tufts all along the
" rows; and, together with the natural graſs,
" ſeemed compleatly to have covered the ſurface
" of the ground. The rows were much better
" ſtocked with ſainfoin plants in the twelve acres
" ſown with it and barley: but the rye-graſs
" abounded here likewiſe.

" It is remarkable, that the ſainfoin flouriſhes
" beſt in thoſe parts of the field where the land is

" moſt

" moſt barren; the reaſon of which undoubtedly " is, that, as ſcarce any natural graſs, or weeds, " ariſe to choak it there, it's young and tender " ſhoots have the benefit of the whole paſture, and " it's roots are not obſtructed in their progreſs by " the growth of other plants.

" Though the greateſt part of this field is much " underſtocked with ſainfoin plants, yet it is in a " very promiſing condition for a good crop of hay " this year.

" I attribute the bad ſucceſs of the ſainfoin on " the firſt four acres, partly to it's being ſowed too " late, whereby the plants could not acquire much " ſtrength before winter, which deſtroyed many of " them; partly to ſome violent hurricanes of " wind, which blew clouds of ſand from one part " of the field to another, and overwhelmed many " plants; and partly to the ſhares going too deep, " by which the ſeed was covered at leaſt two inches. " The bad condition of the five acres ſowed " alone in the ſpring, I believe to be owing, in " ſome meaſure, to the cauſes already aſſigned, and " alſo to the want of protection and ſhelter from " drought, which corn would have afforded in that " very dry ſoil. Barley does alſo help to ſtifle the " natural graſs, ſainfoin's greateſt enemy. The " ſainfoin which was drilled with barley, looked, " as was before obſerved, by much the beſt: but, " indeed, ſome precautions were uſed to ſow the " ſeed ſomewhat ſhallower on theſe twelve acres; " and this may, in ſome degree, have contributed " to it's ſucceſs.

" Upon the whole, from the experiments made " in this field (and ſeveral others made ſince have " ſtrengthened my opinion on that head) I con- " clude, firſt, that ſainfoin is very ſuitable to any " ſandy or deep ſoils, provided they are dry, and " that the natural graſs and weeds can by any

" means

" means be completely deſtroyed: ſecondly, that " it is better to ſow ſainfoin in the ſpring, and " with barley, than in the autumn, or ſpring, " alone: thirdly, that the ſeed ſhould not be co- " vered above an inch deep; but I believe half " an inch the moſt proper depth. One foot may " be a very proper diſtance for drilling the rows; " and from a buſhel to a buſhel and an half, a pro- " per allowance of ſeed for an acre of ground, pro- " vided that ſeed be good.

" I have tried the horſe-hoeing of ſainfoin ſown " on beds three and four feet broad: but, though " the plants do by that means certainly grow more " vigorous, I do not think the crop ſo great; and " when the ſtalks are ſtrong and pipy, I have ob- " ſerved that cattle will not eat them. The ſowing " in equally diſtant rows ſeems preferable, eſpeci- " ally where a large extent of ground is to be " ſowed. But my experience is very inſufficient " to decide this point abſolutely. I could wiſh that " gentlemen would make trials of the horſe-hoeing " of ſainfoin in different ſoils and ſituations.

" Experiments carefully made, and often varied, " by perſons void of prejudice, may, in time, de- " cide that important queſtion in agriculture, *viz.* " whether the common, or the horſe-hoeing, huſ- " bandry be, upon the whole, moſt advantageous " to the Engliſh farmer.

" If ſainfoin be drilled on a ſandy ſoil, or on " one that is in very fine order, the ſhares of the " drill ought to be two inches thick, or they will " go too deep; and a ſmall wooden roller ſhould " be fixed to, and follow, the drill, inſtead of " a harrow with teeth, which would bring too " much earth upon the ſeed. Such a roller will " lay the ground ſmooth, and fitter for mowing. " A ſpring made of three pieces of Aſh, as de-

" ſcribed

"ſcribed by M. Chateuvieux *, is of great uſe, "and may eaſily be added to Mr. Tull's drill "plough. It may be faſtened underneath the "middle of the plank, by four ſcrews, and made "to preſs more or leſs on the roller, or harrow, "which ever is made uſe of, by a wedge put in "betwixt the ſpring and the hinder edge of the "plank. If a harrow is uſed, iron teeth are much "preferable to wooden ones.

"In the year 1757, I had a mind to try how "much a ſoil naturally extremely bad, could be "improved by art. Accordingly, I made choice of "a piece of ground one acre and an half in ex-"tent, a barren ſand, which produced only a few "miſerable weeds, and which the farmer who "rented it did not think worth his while to cul-"tivate. There happened to be a great quantity "of red ſtony marle in an adjoining field, of "which near 300 loads were laid on this acre and "an half. It was drilled with barley in 1758, "and horſe-hoed: but the crop proved a very "bad one. In 1759, a load of lime, and about "ten loads of dung were laid thereon, and it was "drilled with turneps and horſe-hoed: however, "the crop ſtill was but moderate; though "a good deal better than could have been ex-"pected from ſuch a ſoil. In 1760, it had tur-"neps again, managed in the ſame manner as "the former, but they were a great deal better. "In 1761, it was drilled with oats, ſainfoin and "and rye-graſs, mixed, in equally diſtant rows "one foot aſunder. It took two buſhels and a "peck of oats, and two buſhels of graſs ſeeds. "The oats were very good, and produced four "quarters and four buſhels. By continued horſe-"hoeing three years together, the land was got "into perfectly fine order, the marle and ſand

* See *Vol.* II. *p.* 36.

were

" were thoroughly incorporated, and the natural " graſs and weeds intirely deſtroyed: ſo that the " ſainfoin and rye-graſs grew and flouriſhed ex- " ceedingly. In 1762, the ſummer being un- " commonly dry, the produce was about half a " load of hay; which was as much as one could " expect the firſt year after ſowing. It is very " well ſtocked with plants, which now, in May " 1763, ſeem as vigorous as in any of my other " fields, though I have ſome which yield two tons " of hay to an acre. This little piece of ground, " which before was not worth a ſhilling a year, is, " by the labour and coſt beſtowed on it, now " worth at leaſt fifteen ſhillings an acre; which is " a proof that, let land be ever ſo bad, it may be " improved, and perhaps made equal to the beſt " in the neighbourhood: but at the ſame time it " muſt be confeſſed, that the expence is too great " to be repeated at once on a large extent of " ground. I calculate that 300 loads of marle, " dug and carried about 300 yards, might coſt " about four pence a load, or five pounds for 300 " loads, which has been the whole expence at- " tending this acre and half: for the manure, " plowings, and horſe-hoeings, were repaid by the " crops of barley, oats, and turneps."

The experiments mentioned by Mr. Duhamel, relative to the culture of ſainfoin, are theſe.

In 1754, M. Eyma, near Bourdeanx, planted ſainfoin, lucerne, and clover, in rows eight feet aſunder, with diſtances of ſixteen inches between the plants in the rows, which yielded him an immence increaſe. They alleys were horſe-hoed after each cutting[a].

In 1755, he planted a field, a little more than three roods ſquare, with ſainfoin, which he culti-

[a] *Culture des Terres, Tom.* IV. *c.* 1. *p.* 25.

vated

vated according to the rules of the new husbandry; and this ſpot yielded him 10,000 pounds of dry hay. M. de Chateauvieux had 15,300 pounds of lucerne, as we ſhall ſee, off ſomewhat more than an acre of ground, which he cut five times: but M. Eyma thinks that 14445 pounds, Geneva weight, of ſainfoin, which he had at another time, at one cutting, is a greater crop than M. de Chateauvieux's lucerne; beſides the after crop, which indeed was but inconſiderable, on account of the dryneſs of the ſeaſon. He ſays he cuts his ſainfoin three times in good years, and that the two laſt cuttings produce nearly as much as the firſt: but he allows, that ſuch years are not to be expected often [b].

M. Eyma doubts whether the preference be due to ſainfoin, or to lucerne: but he is confident that either of them, properly cultivated, will produce ſurprizing crops.

He thinks that one row of ſainfoin, or lucerne, planted in the middle of a bed three feet wide, will profit more by the different hoeings, and conſequently produce more graſs, than double or triple rows, though theſe laſt be planted on broader beds; becauſe the ſingle rows have the earth looſened on each ſide of them.

M. Diancourt ſowed ſainfoin, each plant of which, in 1753, had a head of two feet diameter. They throve ſo well, that, in 1755, one plant, and that not the largeſt in the field, yielded 23 ounces of hay [c].

[b] *Ibid. Tom.* V. *c.* 1. *p.* 73. [c] *Ibid. p.* 7.

ART I.

ARTICLE III.

Of Lucerne.

EIGHT ſpecies of this plant are diſtinguiſhed by Mr. Miller: but J. Bauhin's *Medica major, erectior, floribus purpuraſcentibus*, greater upright Medic, with purpliſh flowers, is that which is cultivated for the food of cattle, and, in all probability, the *Medica* of Virgil, Columella, Palladius, and other ancient writers of huſbandry. It is the *Alfaſa* of the Spaniards, and the *Lucerne, grand Treſſle*, or *Fænum Burgundiacum*, as ſome botaniſts call it, of the French. It has a perennial root, and an annual ſtalk, which riſes full three feet high in good land, and is garniſhed, at each joint, with trifoliate leaves, whoſe lobes are ſpear-ſhaped, about an inch and a half long, and half an inch broad, ſawed towards their ſtalks. The flowers grow in ſpikes, which are from two, to near three inches in length, ſtanding upon naked foot ſtalks two inches long riſing from the wings of the ſtalks: they are of the pea bloom, or butterfly, kind; of a fine purple colour, and are ſucceeded by compreſſed moon-ſhaped pods, which contain ſeveral kidney-ſhaped ſeeds. It flowers in June and it's ſeeds ripen in September.

There are the following varieties of this ſpecies of lucerne, viz. one with violet coloured flowers; another with yellow flowers; a third with yellow and violet flowers mixed; and a fourth with variegated flowers: but, as Mr. Miller obſerves[a], theſe are only variations of the ſame plant, ariſing accidentally from the ſeed. However, neither the yellow, nor the variegated, flowered lucerne is

[a] *Gardener's Dict.* Art. Medica.

ever

ever ſo ſtrong as that with purple flowers, nor is it, conſequently, ſo profitable to the huſbandman.

Columella calls this [b] the choiceſt of all fodder, becauſe it will laſt ten years *, and will bear being cut down four, and ſometimes ſix times in a year; becauſe it enriches the land on which it grows, fattens the cattle fed with it, and is a remedy for ſick cattle; and becauſe a *jugerum* (about three quarters of an acre) of it is abundantly ſufficient to feed three horſes during the whole year.

This plant is ſuppoſed to have taken it's name *medica*, from *Media*, whither Darius Hyſtaſpes is ſaid to have carried great quantities of it for provender for his horſes, when he invaded Greece, and by that means it's ſeeds were ſcattered there. Whether the Romans had it firſt from thence, when they conquered that country, I ſhall not pretend to ſay: but certain it is, that they eſteemed it highly, as appears from all their authors who have treated of rural affairs.

Yet, notwithſtanding it was ſo much eſteemed by the antients, and hath been cultivated to great advantage in France and Swiſſerland for many years, it has not yet found ſo good reception in England as it juſtly deſerves, nor is it cultivated here in any conſiderable quantity, though it will ſucceed as well in this country as in either of the laſt mentioned; being extremely hardy, and reſiſting the ſevereſt cold of our climate: as a proof of which Mr. Miller obſerves, that the ſeeds which have happened to be ſcattered upon the ground in autumn, have come up, and the plants, after enduring the cold of a ſevere winter,

b *De Re ruſtica, Lib.* II. *c.* 11.

* We ſhall find that it will laſt even much longer, Pliny, indeed, ſays thirty years.

have

have been very fine and ſtrong. He continues thus [c].

"About the year 1650, the ſeeds of this plant "were brought over from France, and ſown in "England: but whether for want of ſkill in it's "culture, whereby it did not ſucceed, or that the "people were ſo fond of going on in their old "beaten road, as not to try whether it would ſuc-"ceed here or not, was the occaſion of it's being "entirely neglected in England, I cannot ſay: "but it is very certain that it was neglected many "years, ſo as to be almoſt forgotten. However, "I hope, before I quit this article, to give ſuch "directions for it's culture, as will encourage the "people of England to make farther trial of this "valuable plant, which grows in the greateſt heat, "and alſo in very cold countries, with this differ-"ence only, that in very hot countries, ſuch as the "Spaniſh Weſt-Indies, *&c.* where it is the chief "fodder for their cattle at this time, they cut it "every week; whereas in cold countries it is ſel-"dom cut oftener than three or four times a year. "And it is very likely, that this plant will be of "great ſervice to the inhabitants of Barbadoes, "Jamaica, and the other hot iſlands in the Weſt-"Indies, where one of the greateſt things they "want is fodder for their cattle; ſince by the ac-"count given of this plant by F. Feuillé, it "thrives exceedingly in the Spaniſh Weſt-Indies, "particularly about Lima, where they cut it every "week, and bring it into the market to ſell, and "is there the only fodder cultivated.

"It is alſo very common in Languedoc, Pro-"vence, and Dauphiné, and all over the banks of "the Rhône, where it produces abundantly, and "may be mowed five or ſix times in a year. Horſes,

[c] *Gardener's Dict. ubi ſupra.*

"mules,

" mules, oxen, and other domeſtick cattle, love
" it exceedingly; but above all when it is green,
" if they are permitted to feed on it, and eſpecially
" the black cattle, which will feed very kindly up-
" on the dried plant, the exceſs of which is, by
" many people, thought to be very dangerous:
" but it is ſaid to be exceeding good for milch cat-
" tle, to promote their quantity of milk; and is
" alſo ſaid to agree with horſes the beſt of all,
" though ſheep, goats, and moſt other cattle, will
" feed upon it, eſpecially when young.

" The directions given by all thoſe who have
" written of the culture of this plant are very im-
" perfect *; for moſt of them order the mixing
" of this ſeed with oats or barley (as is practiſed
" for clover;) but in this way it ſeldom comes
" up well; and, if it does, it will draw up ſo weak
" by growing amongſt the corn, as not to be re-
" covered under a whole year, if ever it can be
" brought to it's uſual ſtrength again.

" Others have directed it to be ſown upon a
" low rich moiſt ſoil; which is found to be the
" worſt, next to a clay, of any for this plant; in
" both which the roots will rot in winter, and in
" a year or two the whole crop will be deſtroyed.

" The ſoil in which this plant is found to ſuc-
" ceed beſt in this country is, a light, dry, looſe,
" ſandy land, which ſhould be well plowed and
" dreſſed, and the roots of all noxious weeds,
" ſuch as couch graſs, *&c.* deſtroyed; otherwiſe
" theſe will over-grow the plants while young,
" and prevent their progreſs.

" The beſt time to ſow the ſeed is about the
" middle of April, when the weather is ſettled
" and fair: for if you ſow it when the ground is

* I believe that M. de Chateauvieux's directions, and his experiments, will appear in a different light.

" very wet, or in a rainy ſeaſon, the ſeeds will " burſt and come to nothing (as is often the caſe " with ſeveral of the leguminous plants); there- " fore you ſhould always obſerve to ſow it in a " dry ſeaſon, and if there happens ſome rain in " about a week or ten days after it is ſown, the " plants will ſoon appear above ground.

The frequent bad ſucceſs of the culture of this plant, when ſown in broad caſt, has been, in a great meaſure, owing to the quantity of natural graſs which grows with it, and choaks it. Columella cautions the husbandman particularly againſt this enemy; and ſome gentlemen who have lately attempted to clear their lucerne of the graſs and weeds, by drawing a drag-harrow a-croſs the ground, have found this labour attended with conſiderable advantage. Mr. Rocque has improved this practice, and made it anſwer far beyond any thing that one would expect from his deſcription of it[e]; as appears by the conſtantly thriving ſtate of his plants, and the great returns of his crops. His directions are to this effect.

" Prefer the ſtrongeſt and deepeſt land; becauſe, though lucerne will grow on almoſt any ſoil where water does not ſtand in the winter ſo as to rot it's roots, that will afford the beſt crops, if it has been ſufficiently plowed and harrowed, in proportion to it's ſtiffneſs, and thoroughly cleaned from all ſorts of weeds, as is done for barley. When the ground has been brought to this fine tilth, by which it will have been well mellowed and ſweetened, manure it juſt before the laſt plowing, not with old rotten ſtuff, as is uſually done, but with freſh ſtable dung that has been thrown up in a hill three or four weeks to ferment; and let this be laid on when in it's full fermentation,

[e] *Practical Treatiſe of cultivating Lucerne.*

and

and plowed in as ſoon as poſſible, that the ſalts of the dung may not have time to evaporate: then harrow the land, ſow it broad caſt (not in drills), and harrow the ſeed in with a light harrow or a buſh harrow; and laſtly, run a roller over it, to ſettle the ground and break the clods. About fourteen pounds of ſeed are the proper allowance for an acre, if it be ſown alone: but if corn is to be ſowed among it, half that quantity will be ſufficient. Sowing it alone is by much the beſt way, becauſe the corn will always be apt to deſtroy the lucerne, eſpecially if the former be ſtrong, and the ſeaſon prove wet.

"In Languedoc, no corn is ſown with it, and the lucerne is mowed when it is ſix or ſeven inches high; by which means all the heads of annual weeds are cut off, and prevented from ſeeding.

"In Normandy, where the climate is much the ſame as in England, corn is ſowed with the lucerne.

"In Picardy, and about Pairs, ſome ſow it with corn, and others without.

"About Avignon, when the lucerne begins to decline, the ground is manured and plowed anew, and ſown with corn and lucern. The old roots then ſhoot up again with the ſeed, and make another fine crop: for the plowing does not hurt them.

"If a full crop of barley is ſowed with the lucerne, and the barley grows very ſtrong, the beſt way is to mow down the barley when it is in ear.

"Freſh broke up land ſhould be tilled a year or two before it is ſowed with lucerne. Peas and beans for one year will help to prepare it well; but potatoes excel all other plants for ſweetening and mellowing the ſoil. The next year, a fallow for turneps will be proper; and if theſe are fed

off with ſheep, the ground will be greatly enriched thereby.

" If forward peas are ſown on land newly broken up, in order to prepare it for lucerne, a crop of turneps may ſucceed as ſoon as the peas are taken off, and the turneps may be fit to feed off by Chriſtmas. As ſoon as they are removed, plough the ground, and let it lie fallow till a proper time to ſtir it again, or give it a trench plowing, which will be of great ſervice, either now or at the very firſt.

" Lucerne may be ſown from the beginning of March to the end of May: but April, if the weather be dry, is the beſt time. Later than May would be hazardous; becauſe there is then moſt danger of drought, and conſequently of the young plants being eaten up by the fly.

" If much wet falls on the new ſown lucerne, it will be apt to ſwell too faſt, and burſt: but if the weather continues fine for three or four days after the ſowing, that danger will be over.

" When the lucerne is a year old, go over the whole ground with a large harrow, as often as is ſufficient to root up the annual weeds and graſs. This muſt be done in dry weather, that the weeds and graſs may be killed before the lucerne begins to ſprout, which is very early in the ſpring: and at the ſame ttime, if you ſee any patches where the ſeed has miſcarried, a little ſeed ſhould be ſprinkled over them, and harrowed in: or, which will amply repay the expence with a large crop, give them firſt a dreſſing with rotten dung.

" The harrow will not hurt the lucerne, whoſe roots are very tough: and if it ſhould cut, or wound, any of them, they will nevertheleſs ſprout and grow.

" In the ſecond ſpring after ſowing, plow the ground where the lucerne grows, with a drill plough,

plough, with a round ſhare, without a fin or feather, and without a coulter, that the roots may not be hurt too much. Let it lie rough a few days, to dry and mellow; and then, in fair weather, harrow it down fine, that it may be mowed the cloſer.

" This ſpring plowing among the lucerne muſt be repeated annually. It kills the graſs and weeds. and makes the ground ferment, which promotes vegetation: and the oftener it is refreſhed with a little dung on the ſurface, the better the crops will be. If the dung be laid on before the winter, that it's ſalts may be waſhed in by the rain and ſnow, and if it be plowed in, in the ſpring, it will greatly add to the cultivator's profit.

" Lucerne is the moſt profitable of any ſort of fodder to feed horſes with in the ſummer, by mowing it, and giving it to them green. It's produce will be proportioned to the goodneſs and depth of the ſoil. In excellent land, properly tilled, it will be almoſt incredible. Mr. Rocque has ſeen it mowed five times in a ſeaſon, and it has yielded, at the five mowings, near eight loads of hay on an acre. But in this caſe, indeed, it has not been let run to ſeed.

" If it be let ſtand too long before it is mowed, it's ſtalks will be too hard for cattle to eat them, and it will loſe much of it's goodneſs,

" To make hay of lucerne, it ſhould be mowed as ſoon as the bloom appears, or rather ſooner. It muſt not be ſpread, like common graſs, but muſt lie in ſwarth, as is practiſed for clover, like which it muſt alſo be turned: otherwiſe it's leaves will drop off.

" This hay is good for all ſorts of cattle; and when horſes are fed with it, they muſt not have their otherwiſe full allowance of corn; the lucerne

anſwering, in a great meaſure, the purpoſe of both corn and hay.

"In hot ſummers, the ſeed of the lucerne may be ſaved in England, but not from the firſt growth; that being generally too rank, and ſubject to rot at bottom. In Languedoc, it is ſaved from the third growth: but as this climate is colder, it will not have time to ripen, if it be not ſaved from the ſecond growth. A dry ſoil is the beſt to ſave it upon, becauſe it is not ſo apt to grow rank there; and in this caſe it may poſſibly do from the firſt growth. It will be ripe in September, and muſt be gathered by hand."

To theſe directions Mr. Rocque adds, that a perſon who has not been uſed to the culture of lucerne will be apt to think the plants muſt be deſtroyed by harrowing or plowing among them; but that he can ſhew any gentleman who will take the trouble to call at his houſe (at Walham Green), that experience teaches the contrary.

The harrow with which he weeds his lucerne has two handles, like a plough, inſtead of which it may ſometimes be uſed in light land, ſo as even to ſave ſome labour. The teeth are ſeven or eight inches aſunder in the firſt row, and project about five inches beyond the wood. The ſecond row is placed nine or ten inches behind the firſt, and in ſuch manner that its teeth are oppoſite to the ſpaces in the former row. The teeth of this ſecond row are an inch longer than thoſe in the firſt; ſo that, the ground being looſened a little by the firſt row, theſe go ſomewhat deeper; and the teeth of the third and laſt row are an inch longer than thoſe of the ſecond, and placed ſo as to go in the ſame track as the teeth of the firſt row.

This harrow is made of one ſolid piece of wood, four or five inches thick, and it's lower ſide is rounded

rounded off towards the hinder part, where the teeth are longeſt: by which means the perſon who holds it by the handles, preſſing down a little, may force the ſecond and third rows of teeth deeper than the firſt; and, by bearing up a little, he may prevent any but the firſt row from working. A very little practice will enable any one to uſe it as occaſion requires; and Mr. Rocque ſays it will be ſo ſteady, that no unevenneſs of the ground will be able to throw it out of it's work, as a clod, or ſtone, will do a common harrow.

Mr. Rocque's method may anſwer very well in light mellow ground; though I fear it will not where the land is ſtrong and binding. This laſt is, indeed, a ſoil on which lucerne is very ſeldom ſown, and which almoſt all writers have declared to be improper for it. But I have the pleaſure of acquainting the reader, that an experiment made in Surrey, on a ſtrong clay, has evinced their miſtake, and now proves, that this plant will ſucceed on a ſoil of that kind, full as well as on any other, if it be properly managed.

The gentleman to whom I owe the certainty of this fact, but whoſe name I am not at liberty to mention; too active, and too prudent, to loiter away his time, like many of his brother officers, devotes his attention, when relieved from military duty, to his own real emolument, and to the peaceful ſervice of his country. In this laudable purſuit, he determined to try what good culture would effect on ſuch a ſoil. To this end he drilled three acres with lucerne, which he weeded carefully the firſt year; and from the places where it grew too thick, he ſupplied thoſe in which it had failed. He contrived a horſe-hoe, ſomewhat in the manner of M. de Chateauvieux's cultivator, very eaſily drawn by one horſe. After every weeding, he ſtirred the alleys with this cultivator,

which manifeſtly revived his plants. They throve greatly the ſecond year, and are now, which is their third, in ſuch perfection, that he has fed five horſes on the produce of their cuttings, ever ſince the middle of May, and they cannot conſume the whole of it. The conſtant rains during this laſt month of July have prevented his making any of it into hay, which he intends to do as ſoon as the ſeaſon will permit. Theſe horſes, though conſtantly worked very hard, have not had either corn or hay during all this time; and yet they continue in ſtrength and ſpirit, and grow fat. A horſe which, in May, was ſo weak, and in ſo bad a ſtate, that it was thought he could not live, ſoon recovered when he was fed with lucerne, and was continued in a conſtant labour, which, in the opinion of all who ſaw him, he could not have executed, had it not been for this food. The plants were about three feet high at the firſt cutting, and, in general, between three feet and three feet and a half at the ſecond, and grew in ſo large tufts, that no diſtance appeared between the drills.

After every cutting, this judicious experimenter hoes the alleys with what I call his cultivator; and if he finds that the weeds have not been ſufficiently deſtroyed thereby, he uſes a paring hoe, like that deſcribed in the firſt volume of this work (page 216, note *, and *Pl.* III. *Fig.* 8), excepting that the ſtandards, or upright pieces, there marked C C, paſs through an axle-tree, inſtead of the block B, and are pinned thereto, at whatever height is thought moſt proper, ſo as to be made to enter into the earth to any depth deſired. The ends of this axle-tree paſs through two wheels, and ſhafts are fixed to it (only one horſe being uſed here), inſtead of the pole and fore-carriage in the above-mentioned engine. With this hoe, the roots

roots of all weeds in the alleys are cut aſunder under the ſurface of the earth, and their ſevered heads ſoon wither, or may eaſily be carried off the ground.

It is manifeſt that theſe three acres of lucerne would more than maintain ſix horſes during the ſummer and autumn; which, computing the rent of the land, and the ſmall expence attending the culture of this plant, will be found to be a very great ſaving, when compared with the price of the hay and corn neceſſary for ſuch horſes, in the common way.

Mr. Miller's directions are agreeable to this gentleman's practice, when he adviſes the following method of cultivating lucerne.

"After having well plowed and harrowed the "land very fine, you ſhould make a drill quite "a-croſs the ground; almoſt half an inch deep, into "which the ſeeds ſhould be ſcattered very thin: "then cover them over a quarter of an inch thick, "or ſomewhat more, with the earth: then pro-"ceed to make another drill, about a foot and a "half from the former, ſowing the ſeeds therein "in the ſame manner as before, and ſo proceed "through the whole ſpot of ground, allowing "the ſame diſtance between row and row, and "ſcatter the ſeeds very thin in the drills. In "this manner, an acre of land will require about "ſix pounds of ſeed: for when it is ſown thicker, "if the ſeeds grow well, the plants will be ſo "cloſe as to ſpoil each other in a year or two, the "heads of them growing to a conſiderable ſize, "as will alſo the roots, provided they have room. "I have meaſured the crown of one root, which "was in my poſſeſſion, eighteen inches diameter; "from which I cut near four hundred ſhoots at "one time, which is an extraordinary increaſe, and "this upon a poor dry gravelly ſoil, which had

"not

" not been dunged for many years, but the root " was at leaſt ten years old; ſo that if this crop " be well cultivated, it will continue many years *, " and be equally good as when it was firſt ſown; " for the roots generally run down very deep in " the ground, provided the ſoil be dry; and al- " though they ſhould meet a hard gravel a foot " below the ſurface, yet their roots would pene- " trate it, and make their way downward, as I " have experienced, having taken up ſome of " them, which were above a yard in length, and " had run two feet into a rock of gravel, ſo hard " as not to be looſened without mattocks and " crows of iron, and that with much difficulty.

" The reaſon for directing this ſeed to be ſown " in rows is, that the plants may have room to " grow; and for the better ſtirring the ground " between them, to deſtroy the weeds, and en- " courage the growth of the plants, which may " be very eaſily effected witha Dutch hoe, juſt after " the cutting the crop each time, which will cauſe " the plants to ſhoot again in a very little time, and " be much ſtronger than in ſuch places where the " ground cannot be ſtirred: but when the plants " firſt come up, the ground between ſhould be " hoed with a common hoe; and if in doing of this " you cut up the plants where they are too thick, " it will cauſe the remaining to be much ſtronger. " This hoeing ſhould be repeated two or three " times while the plants are young, according as " the weeds are produceed, obſerving always to do " it in dry weather, that the weeds may the better

* M. Duhamel likewiſe ſays, that it will continue a long time on the ſame ground, if care be taken that the natural graſs or weeds do not choak it; for as ſoon as any other plants come up among lucerne, it decays gradually and dies, ſo that very little of it will remain at the end of a few years.

" be

" be deſtroyed; for if it be done in moiſt weather, " they will root and grow again.

" With this management, the plants will grow " to the height of two feet, or more, by the begin- " ning of Auguſt, when the flowers will begin to " appear, at which time the lucerne ſhould be " cut, obſerving to do it in a dry ſeaſon, if it is " to be made hay, and keep it often turned, that " it may ſoon dry, and be carried off the ground; " for if it lie long upon the roots, it will prevent " their ſhooting again. After the crop is taken " off, you ſhould ſtir the ground between the rows " with a hoe, to kill the weeds, and looſen the " ſurface, which will cauſe the plants to ſhoot out " again in a ſhort time, ſo that by the beginning " of September there will be ſhoots four or five " inches high, when you may turn in ſheep upon " it to feed it down: nor ſhould the ſhoots be " ſuffered to remain upon the plants, which would " decay when the froſty weather comes on, and " fall down upon the crown of the roots, and " prevent their ſhooting early the ſucceeding " ſpring.

" The beſt way therefore is to feed it until " November, when it will have done ſhooting for " that ſeaſon: but it ſhould not be fed by large " cattle the firſt year, becauſe the roots being " young, would be in danger of being deſtroyed, " either by their trampling upon them, or their " pulling them out of the ground: but ſheep " will be of ſervice to the roots by dunging the " ground, provided they do not eat it too cloſe, " ſo as to endanger the crown of the roots.

" In the beginning of February, the ground be- " tween the rows ſhould be again ſtirred with the " hoe, to encourage them to ſhoot again: but in " doing of this you ſhould be careful not to " injure the crown of the roots, upon which the

" buds

" buds are at that time very turgid, and ready to
" puſh. With this management, if the ſoil be
" warm, by the middle of March the ſhoots will
" be five or ſix inches high, when, if you are in
" want of fodder, you may feed it down till a
" week in April; after which it ſhould be ſuffered
" to grow for a crop, which will be fit to cut the
" beginning of June, when you ſhould obſerve to
" get it off the ground as ſoon as poſſible, and
" ſtir the ground again with the Dutch hoe, which
" will forward the plants ſhooting again, ſo that
" by the middle, or latter end of July, there will
" be another crop fit to cut, which muſt be ma-
" naged as before; after which it ſhould be fed
" down again in autumn: and as the roots by this
" time will have taken deep hold in the ground,
" there will be little danger of hurting them,
" if you ſhould turn in larger cattle; but you
" muſt always obſerve not to ſuffer them to
" remain after the roots have done ſhooting, leſt
" they ſhould eat down the crown of the roots
" below the buds, which would conſiderably
" damage, if not deſtroy them.

" In this manner you may continue conſtantly
" to have two crops to cut, and two feedings upon
" this plant, and in good ſeaſons there may be
" three crops cut, and two feedings, which
" will be a great improvement, eſpecially as this
" plant will grow upon dry barren ſoils, where
" graſs will come to little, and be of great uſe in
" dry ſummers, when graſs is often burnt up:
" and as it is an early plant in the ſpring, ſo it
" will be of great ſervice when fodder falls ſhort
" at that ſeaſon, when it will be fit to feed at leaſt
" a month before graſs or clover; for I have had
" this plant eight inches high by the tenth of
" March, old ſtyle, at which time the graſs in the
" ſame place has ſcarcely been one inch high.

" That

" That cold will not injure this plant, I am fully " ſatisfied *; for in the very cold winter, Anno " 1728—9, I had ſome roots of this plant which " where dug up in October, and laid upon the " ground in the open air till the beginning of " March, when I planted them again, and they " ſhot out very vigorouſly ſoon after: nay, even " while they lay upon the ground, they ſtruck out " fibres from the under ſide of the roots, and had " begun to ſhoot green from the crown of the " roots. But that wet will deſtroy the roots, I am " fully convinced; for I ſowed a little of the ſeed " upon a moiſt ſpot of ground for a trial, which " came up very well, and flouriſhed exceedingly " during the ſummer ſeaſon, but in winter, when " the great rains fell, the roots began to rot " at bottom, and before the ſpring moſt of them " were deſtroyed.

" The beſt places to procure the ſeed from, are " Switzerland and the northern parts of France, " which ſucceeds better with us than that which " comes from a more ſouthern climate: but " this ſeed may be ſaved in England in great " plenty; in order to which, a ſmall quantity of " the plants ſhould be ſuffered to grow uncut till " the ſeeds are ripe, when it muſt be cut, and laid " to dry in an open barn where the air may freely " paſs through: but the ſeed muſt be defended " from the wet; for if it be expoſed thereto, it " will ſhoot while it remains in the pod, whereby " it will be ſpoiled. When it is quite dry, it muſt " be threſhed out, and cleanſed from the huſk, " and preſerved in a dry place till the ſeaſon for " ſowing it: and this ſeed ſaved in England is

* This is confirmed by M. Duhamel, who ſays that the hard winter in 1709, which killed almoſt all the olive trees in France, did no great damage to the lucerne.

" much

" much preferable to any brought from abroad,
" as I have ſeveral times experienced; the plants
" produced from it having been much ſtronger
" than thoſe produced from the French, Helve-
" tian, and Turkey ſeeds, which were ſown at the
" ſame time, and on the ſame ſoil and ſituation.

" I am inclinable to think that the reaſon of
" this plant's not ſucceeding, when it has been ſown
" in England, has either been occaſioned by the
" ſowing it with corn, with which it will by no
" means thrive * (for though the plant be very
" hardy when grown pretty large, yet at it's firſt
" coming up, if it be incommoded by any other
" plant or weeds, it ſeldom does well; therefore
" it ſhould always be ſown by itſelf, and carefully
" cleared from weeds until it has ſtrength, after
" which it is not eaſily deſtroyed;) or, perhaps,
" people have ſown it at a wrong ſeaſon, or in
" wet weather, whereby the ſeeds have rotted, and
" never come up, which hath diſcouraged their
" attempting it again: but however the ſucceſs
" has been, I dare aver, that if the method of
" ſowing or managing of this plant, which is here
" laid down, be duly followed, it will be found to
" thrive as well as any other ſort of fodder now
" cultivated in England, and will continue much
" longer: for if the ground be duly ſtirred after the
" cutting of each crop, and the firſt crop fed, as
" hath been directed, the plants will continue in
" vigour twenty years, or more, without renewing
" provided they are not permitted to ſeed, which
" would weaken the roots more than four times
" cutting would do.

" The hay of this plant ſhould be kept in cloſe
" barns, it being too tender to be kept in ricks

* M. Duhamel alſo is abſolutely againſt ſowing it with corn, or any other plant.

" open

" open to the air as other hay: but it will remain " good, if well dried before it be carried in, three " years. The people abroad reckon an acre of " this fodder ſufficient to keep three horſes all the " year round: and I have been aſſured by perſons " of undoubted credit, who have cultivated this " plant in England, that three acres of it have " fed ten cart horſes from the end of April to the " beginning of October, without any other food, " though they have been conſtantly worked. In- " deed the beſt uſe that can be made of this graſs " is, to cut it and give it green to the cattle. " Where this hath been daily practiſed, I have " obſerved that by the time the field has been cut " over, that part which was firſt cut, hath been " ready to cut again; ſo that there has been a " conſtant ſupply in the ſame field, from the mid- " dle of April to the end of October, when the " ſeaſon has continued long mild; and when the " ſummers have proved ſhowery, I have known " ſix crops cut in one ſeaſon: but in the dry ſea- " ſons there will be always three. When the plant " begins to flower, it ſhould then be cut; for if " it ſtands longer, the ſtalks will grow hard, and " the under leaves will decay, and then the cattle " will not ſo readily eat it. Where there is a " quantity of this cultivated, ſome of it ſhould " be cut before the flowers appear, otherwiſe " there will be too much to cut within a proper " time.

" When this is made into hay, it will require a " great deal of making: for as the ſtalks are " very ſucculent, it muſt be often turned, and ex- " poſed a fortnight before it be fit to houſe; for " this requires a longer time to make than ſain- " foin: therefore, when it is cut it ſhould be " carried to make upon ſome graſs ground; be- " cauſe the earth in the intervals of the rows

" will

" will waſh up, and mix with the hay in every ſhower " of rain; and by carrying it off as ſoon as it is " cut, the plants will ſhoot out again ſoon: but it " is not ſo profitable for hay, as to cut green for " all ſorts of cattle, but eſpecially horſes, which " are extremely fond of it; and to them it will " anſwer the purpoſe of both hay and corn, and " they may be worked at the ſame time juſt as " much as when they are fed with corn, or dry " food."

To theſe inſtructions of Mr. Miller, I ſhall only add a few remarks made by M. Duhamel [a], and and then proceed to the experiments which ſome of his correſpondents, and particularly M. de Chateauvieux, have made upon the culture of lucerne according to the principles of the new husbandry.

Lucerne, like ſainfoin, may be cut, either before it bloſſoms, while it is in bloom, or when the ſeed is ripe. The only things to be obſerved are,

1. That it makes the beſt fodder, when cut before it's lateral ſhoots come out, and conſequently a good while before it bloſſoms.

2. That the earlier it is cut, the ſooner it produces a new crop.

3. That lucerne requires more time to dry it into hay, than ſainfoin: but yet it muſt not be left long upon the field, leſt it ſhould heat, and damage the young ſhoots riſing for another crop.

4. That rain hurts lucerne, when cut, more than it does ſainfoin. It ſhould therefore be houſed as ſoon as it is dry: for this hay cannot be preſſed ſo cloſe together, in cocks, but that the water will penetrate into it, and rot it.

5. If lucerne grows yellow before it is in bloom, it is an almoſt certain ſign that it's root

[a] *Culture des Terres, Tom. I. c. 27. p. 107.*

is attacked by ſome inſect in the earth. The beſt way in this caſe is to cut it down, that the graſs may not be loſt, and that the inſects may be deſtroyed before they entirely conſume the root.

6. When the ſeed is to be ſaved, it muſt ſtand till it is quite ripe, and that crop of graſs is loſt.

When the ſeed is quite ripe, the tops of the plants, where the pods grow; ſhould be cut off with a ſharp ſickle, (ſhaking them as little as poſſible,) and laid in a cloth held ready to receive them, on which they are dried in the ſhade, and then beat out and cleaned. The reſt of the graſs is afterwards cut down; rather to clear the field, than for any uſe it can be of; being then too coarſe and hard.

Experiments on Lucerne cultivated according to the new huſbandry, by M. DE CHATEAUVIEUX.

"IT is truely with regret, ſay M. de Chateauvieux [b], that I am forced to treat a ſubject of this importance, in ſo ſummary a way as the limits of this letter* require. However, I hope that even this general account of my experiments may be a guide to thoſe who would cultivate this plant. Many perſons who live at a conſiderable diſtance from this place †, have already followed my example, and are extremely well ſatisfied with their ſucceſs.

"Though I agree with M. Duhamel and the other partiſans of the new huſbandry, that lucerne and ſainfoin thrive beſt when cultivated in beds; yet my practice differs, in many reſpects, from theirs. This difference conſiſts in,

b *Culture des Terres, Tom.* IV. *c.* 3. *art.* 15.

* His letter to M. Duhamel. † Geneva.

1. *The principle which I apply particularly to the culture of Lucerne.*

"LUCERNE grows naturally with one large perpendicular, or tap, root, which penetrates very deep into the earth, and has few, if any, lateral roots. From ſimilar experiments on other tap-rooted plants, I was induced to think, that this too, by tranſplanting it, and at the ſame time cutting off part of it's tap-root, might be made to ſhoot out ſeveral horizontal roots, which, reaching into the looſe mould of the alleys, and extending themſelves there, would collect a greater quantity of nouriſhment for the plant, and conſequently enable it to produce more abundant crops.

"The event has proved, that when we reaſon on ſound principles, we ſeldom err. My tranſplanted lucerne puſhed out numbers of large lateral roots, and theſe branched out again into others, which may be multiplied without end by frequent culture of the alleys: for the horſe-hoe has the ſame effect on theſe horizontal roots, as cutting has upon the tap-root.

2. *The method of tranſplanting the Lucerne.*

"I Made ſeveral beds, ſome about three feet wide, (including the alleys,) into which I tranſplanted a ſingle row of lucerne; others about three feet nine inches, into which I tranſplanted two rows; and others about four feet three inches wide, in which I put three rows. The deſign of this variation was, to ſee by which of theſe three methods the ſame extent of ground will produce the greateſt quantity of lucerne. I believe it will require five or ſix years to determine exactly which of

of them will be beſt; becauſe, as the plants increaſe every year in bulk, their produce alters, and may perhaps not keep in proportion to the firſt years, though probably the difference will not be great. But without waiting ſo long, I can already ſee, that the crop will be greateſt by planting only one row on each bed.

"The plants in the ſingle rows were ſix inches aſunder, nor ſhould they ever be nearer; and thoſe in the double and triple rows, were eight or nine inches diſtant from each other. I muſt obſerve, that I likewiſe ſowed lucerne with the drill, in beds, in which it has remained without tranſplanting. It is very fine; but not near ſo ſtrong and flouriſhing as that which I tranſplanted. When lucerne is ſown where it is to remain, it neceſſarily requires being thinned, and that operation takes up more time than tranſplanting it would do."

Rules to be obſerved in tranſplanting Lucerne into beds.

"1. THE middle of the beds muſt be raiſed and arched as high as poſſible; and as the lucerne is to remain ſeveral years on the ſame ground, no pains ſhould be ſpared to prepare the earth as well as can be.

"2. Lucerne ſhould be ſown in the ſpring, and in a rich mould, that the plants may be ſtrong enough to tranſplant in September.

"3. Plants two or three years old, may be tranſplanted as well as younger ones.

"4. They ſhould be tranſplanted in September, that they may have time to take freſh root before the winter comes on.

"5. If they cannot conveniently be tranſplanted in September, it may be done in October, provided the weather be not froſty.

"6. The mould into which they are tranſplanted ſhould be moiſt; and if the weather be ſomewhat rainy, it is ſo much the better. In this caſe, I have never found it neceſſary to water the plants.

"7. If lucerne is tranſplanted in November or December, there is danger of the froſts forcing many of the plants out of the ground.

"8 If too warm and dry a ſeaſon prevents tranſplanting in September or October, it is beſt to ſtay till the winter is paſt. The plants will then be ſure of taking root, and very few of them will fail.

"9. If they can be tranſplanted in autumn, they will yield pretty good crops the next year: but if they are not tranſplanted till ſpring, the next year's crop will be but indifferent.

"10. The plants muſt be taken up out of the nurſery, with great care and patience, that their roots may not be damaged.

"11. The roots ſhould be left about ſix or ſeven inches long, and the green tops ſhould be cut off within about two inches of the crown of the root.

"12. The plants will take root the ſooner, if they are put into water as ſoon as they are taken up, and kept in it they till are planted.

"13. They are planted in holes made with a planting ſtick, in the ſame manner as cabbages or lettuces are planted in a garden.

"14. The beſt way of planting lucerne is, to cut a ſtrait channel two or three inches deep, and ſet the plants in the bottom of it, covering them up to the neck.

"15. Great care ſhould be taken not to ſuffer any weeds to grow among the lucerne, at leaſt for the two or three firſt years. To this end, the rows ſhould be weeded by hand, as well as the edge of the

the alleys near the plants, where the horſe-hoe cannot go.

" 16. The alleys may be ſtirred, either with the ſingle cultivator, or the cultivator with two mould boards; which, at the ſame time that it deſtroys the weeds, keeps the mould looſe.

" 17. The firſt ſtirring may be given with the ſingle cultivator, with which a furrow may be cut on each ſide of the main furrow in the middle of the alleys, by which means the earth will be turned over on both ſides of it.

" 18. The ſecond ſtirring may be given with the cultivator with two mould boards, by drawing it along the middle of the alleys. This will turn the earth towards the rows. By theſe alternate ſtirrings, the alley will be conſtantly kept in a looſe ſtate.

" 19. This culture is ſo eaſily performed, and in ſo ſhort a time, that it may be repeated frequently. In this I differ from M. Duhamel, who orders it but ſeldom. My opinion is, that the alley ſhould be ſtirred once a month, during the whole time that the lucerne is in a growing ſtate.

" 20. If the alleys keep free from weeds, leſs ſtirring them may do: but the mould ſhould never be ſuffered to grow too hard.

" 21. As ſoon as ſome of the plants begin to bloſſom, the lucerne ſhould be cut. It will then make excellent fodder, ſuperior to every other kind.

" 22. The lucerne hay ſhould be dried as quick as poſſible, and frequently turned. The leſs it is expoſed to the heat of the ſun, the better fodder it makes.

" 23. Lucerne muſt not be houſed till it is dry: but at the ſame time care muſt be taken that it be not too dry: for then many of the leaves will fall off, as they dry ſooner than the ſtalks.

"24. Cattle muſt not have too much lucerne given them at a time, till they are accuſtomed to it.

"25. No cattle ſhould ever be ſuffered to feed on the beds of lucerne. If the earth is very dry, towards the latter end of the autumn, ſheep will do it the leaſt hurt. If the plants are then tall enough to be mowed, the beſt way is to cut them, and give them green to the cattle.

"Theſe rules contain all that is eſſentially neceſſary for making and keeping in good order this kind of artificial paſture. I can ſafely ſay, that whoever tries them, will be abundantly rewarded for his trouble and expence. Sainfoin may be cultivated in the ſame manner."

Account of the produce of Lucerne planted in beds, and cultivated according to the principles of the new huſbandry: with ſome important reflections on the advantages which may be obtained therefrom: by M. DE CHATEAUVIEUX[c].

"NO judgment ſhould be formed of what lucerne may produce, by the crops of the firſt or ſecond year: it is then too young to be able to yield much. If we were to calculate even by it's third year's produce, we ſhould ſtill conſider, that as the plants increaſe every year in bulk and vigour, (and where they will ſtop I am not yet able to determine,) the produce will be proportioned to that increaſe, and conſequently the crop of each ſucceeding year will be greater than that of the former.

"The crops I am going to ſpeak of, are thoſe of the ſecond and third year: but my calculations will be made on that of the third year. It is pro-

[c] *Ibid, Art.* 16.

per

per to remember, that the years 1753 and 1754 were uncommonly dry, inſomuch that, ſometimes, not a drop of rain, nor ſcarce any dew, fell between the cutting of one crop and that of another. The ſeaſons were ſo unfavourable to the production of graſs, that hay roſe to an exceſſive price.

"I ſhall firſt ſay what was the ſtate of the plants of lucerne in their third year, and afterwards how much hay the yielded.

State of the plants in their third year.

"AS the part of the plant which I now conſider is that which is buried in the earth, I uncovered numbers of them, that I might be able to judge of their general ſtate. I was greatly ſtruck with the effect which tranſplanting had had upon them. Inſtead of one perpendicular root, which they uſually have, all theſe plants had three, four, five, and ſometimes more, almoſt equally big roots. They were, in general, three quarters of an inch in diameter, and proceeded from the original root, which was now at leaſt an inch in diameter, and in many of the plants an inch and a half. After the moſt careful ſearch that I could poſſibly make, I could not find one plant of lucerne ſown in the common way, though it had ſtood twelve, twenty, or more, years, whoſe tap-root had grown to the bigneſs of an inch diameter: few of them were above half, or at moſt three quarters of an inch thick. This difference is very great.

"I likewiſe found that the roots of the tranſplanted lucerne had produced another kind of roots, of which I ſaw none about thoſe of the old lucerne. Theſe were a great number of fibrous roots, ſome of which were already one-twelfth of an inch in diameter, and looked as if they would alſo become principal roots.

"The ſtalks ſeem to riſe out of the earth; and from the firſt time of cutting them, a kind of head forms juſt above ground, which extends itſelf every year. The firſt year, this head was two or three inches wide: the ſecond year, it was generally about ſix inches over, and this third year, almoſt half the plants have a crown ten or twelve inches in diameter: and as many of them have grown ſo as to touch one another, their crowns are become of an oval form, having extended themſelves on the ſides where they met with no reſiſtance.

CROPS.

"I Have a field of lucerne in beds, divided into two parts. This is the third crop of lucerne off one of them. The beds are 250 feet long. In 1753, I cut this lucerne ſix times, *viz.* in May, June, July, Auguſt, September, and the beginning of November. This laſt cutting was not near ſo plentiful as the others, and I dried it within doors.

"Theſe cuttings off one bed, on which there was but one row of lucerne, yielded 140 pounds of well dried hay.

"In 1754, the lucerne was late before it began to ſhoot, and the earth was drier than the year before. I had but five crops: the firſt was cut on the 27th of May; the ſecond, on the 1ſt of July; the third, on the 27th of July; the fourth, on the 26th of Auguſt; and the fifth, on the 23d of October. Theſe five cuttings yielded in all 225 pounds of well dried hay off each bed.

"A field 250 feet long, which was the length of my beds, and 210 feet wide, contains an arpent of our meaſure. This arpent, divided into 68 beds, each three feet wide, producing after the rate of 225 pounds of hay off each bed, would yield

yield in all 15300 pounds *; which is infinitely more than is ever obtained in the common way.

"The beds with three rows yielded much leſs. The third year, their crops amounted to no more than 169 pounds off each bed, which is a fourth leſs than the others: and as theſe beds are wider, inſtead of having 68, as in the former diſpoſition of the arpent, there will be only 47, each four feet three inches wide, the total produce of which will be but 7943 pounds: conſequently this arpent will yield little more than half as much as an arpent laid out in beds three feet wide, planted with only ſingle rows.

REMARKS, *by* M. DE CHATEAUVIEUX.

"THE plants of lucerne had the fate of all kinds of plantations: that is to ſay, ſome of them were more vigorous than others. The greateſt number of the plants produced each of them a pound of dry hay, and ſome of them yielded two pounds. I look upon theſe laſt as ſuch extraordinary productions, that I do not expect many of them to yield the like quantity again. I think one may be very well ſatisfied, if the plants, one with another, yield a pound of hay a-piece every year. This is nearly the reſult of my experiment on beds which had but one row; and the produce of theſe would have been ſtill greater, if many of my plants had not failed: in the room of which I ſet young ones, which could not acquire ſufficient ſtrength to yield full crops.

"In theſe experiments, I have employed no dung: neither have I for any of my corn fields. I have reſerved it for improving my paſtures and

* Upwards of ſeven loads and a half of hay, at 18 hundred weight to the load: which is equal to above ſix loads on an Engliſh acre.

meadows

meadows; and intend next to apply it to my lucerne, which, I doubt not, will be much the finer for it. The only thing now remaining is, to know by experience which will be the beſt way of uſing it. I have ſome thoughts on that head, which may render it much more profitable.

"Lucerne deſerves to be cultivated with care: not only on account of the great quantity of fodder which it yields, but likewiſe becauſe the quality of it's hay is ſuperior to any other. The new huſbandry will render it ſtill more perfect. Plants cultivated this way, enjoy the benefit of a free circulation of the air, and that circulation keeps them ſweet and ſound, and free from all muſtineſs towards their roots: for, being open to the rays of the ſun, that great ſource of kindly vegetation, they attain great perfection in all their parts, both as to their ſubſtance, and their flavour. Cattle eat this food greedily, and are better nouriſhed with it, than with any other: but as every exceſs is bad, too great a quantiiy ſhould not be given them at once, eſpecially at firſt, leſt it ſhould ſwell them. The beſt way is, to bring them to it by degrees.

"I have experienced theſe qualities in this hay, by comparing it with every other ſort. The excellence of this, juſtifies the principles on which the new huſbandry is founded. I have offered to my horſes bundles of every kind of hay, and at the ſame time a bundle of this hay of lucerne. They have not heſitated a moment to prefer the latter. Nothing but it's ſuperior qualities could determine them in this choice, which never varied, and has always been in favour of the lucerne cultivated in this manner.

"It would be laviſhing this excellent fodder, to feed horſes entirely with it. It need only be given them by turns with common hay: which will be

a great ſaving: for this lucerne will ſupply the place of oats. I am certain that my horſes fed partly with this hay, and without oats, will be in better plight, ſtronger, and more vigorous, than thoſe which are fed with meadow hay and corn in the uſual way. Is is now ſome time ſince I have fed my coach horſes with it, and have retrenched their oats. Inſtead of this laſt food, and at the hours they uſed have it, I give them lucerne chopt, as the Spaniards do ſtraw to their horſes. Mine are as fond of it, and ſhew the ſame impatience to find it in their manger, as if it was oats; and ſince their being put under this diet, they are in better condition than before, and ſo mettleſome, that the coachman has enough to do to keep them in.

"When I ſaid that retrenching the oats would be a conſiderable ſaving, I did not ſo much mean the ſaving of the expence of that corn, as the better improving of many vaſt tracts of land which are ſown with oats, and might, with proper management, produce much more uſeful and more profitable ſorts of grain, notwithſtanding the too general prejudice, that ſome lands are not capable of bearing any better. For my part, I am thoroughly ſatisfied, that whatever ground can bear a crop of oats, can likewiſe, under the new huſbandry, bear any other grain."

Continuation of M. DE CHATEAUVIEUX's *account of his experiments on Lucerne, in the years* 1755, *and* 1756[d].

"THE great drought of the year 1755, was accompanied with great heat; and the year 1756 was very rainy, and moderately warm, there being but few very hot days in it.

[d] DUHAMEL, *Culture des Terres, Tom.* V. *c.* 5. ART. 5.

"My

" My lucerne was expoſed to a moſt ſevere winter in 1755, when the froſt was exceſſive hard, and laſted very long. M. de Reaumur's thermometer was ſome days, at different times, 8, 9, 10, 12, and 13 degrees below the freezing point; and on the 3d of February, a thermometer in the open air, ſtood at 16 degrees * below freezing. Theſe ſevere froſts made me uneaſy for my lucerne, which however, bore them, without receiving any damage.

" The rains in 1756 did no hurt to theſe plants, but they prevented my cutting them at proper times. I had but four crops of lucerne this year, being obliged to wait for an appearance of fine weather to dry it in, before I could venture to cut it down. Theſe rains likewiſe hindered my giving the proper hoeings to the alleys, which were full of weeds during the ſummer and autumn. I choſe rather to leave them in that condition, than attempt to hoe them while the ground was over wet: not doubting but the ſpring hoeings would eaſily deſtroy them.

" In 1755, I cut my lucerne five times: the firſt was, on the 3d of May, before any flowers appeared: the ſecond, on the 12th of June: the third, on the 15th of July: the fourth, on the 21ſt of Auguſt; and the fifth, on the 7th of October. I was obliged to finiſh the drying of this laſt cutting, in barns and under cover.

* The greateſt cold in the winter of the year 1739-40, ſunk Farenheit's thermometer to about 12 degrees, equal to 11 degrees below the freezing point of M. de Reaumur's thermometer. The 16th degree below the freezing point of M. de Reaumur's thermometer, anſwers to nearly the 3d degree of Farenheit's: conſequently the cold was, by Farenheit's thermometer, 9 degrees greater in Swiſſerland in 1755, than it was here in the ſevereſt froſt of the very hard winter in 1739-40; and therefore, as M. de Chateauvieux's lucerne was not hurt by that intenſe cold, there can be no fear of this plant's being killed by any inclemency of the weather in this country.

" In

"In 1756, which was the fifth year of these plants, I cut them but four times: the first, on the 3d of June; the second, on the first of July; the third, on the 4th of August; and the fourth, on the 27th of September.

A bed 250 feet long, with only one row of lucerne,

Yielded { In 1754 . . . . 225 / 1755 . . . . 197 / 1756 . . . . 281 } pounds of dry hay.

In three years, 703 pounds.

A bed of the same length, with three rows of lucerne,

Yielded { In 1754 . . . . 169 / 1755 . . . . 180 / 1756 . . . . 226 } pounds of dry hay.

In three years, 575 pounds.

OBSERVATIONS: by M. DE CHATEAUVIEUX.

"WE see, by the above account of three years, that a piece of ground laid out in narrow beds, planted with only one row of lucerne, yielded a greater produce than the same extent made into wider beds, and planted with three rows.

"I shall not, however, pretend to determine from this one experiment, that it is best to lay down large fields in this manner. I think it will be right to try first, whether the success will be the same on different soils, and likewise on lands

lands whoſe expoſition may be more or leſs advantageous. If, after repeated trials, the beds which have but one row of plants, yield the greateſt quantity of hay, that method is certainly to be preferred: To clear up this point ſtill more to my ſatisfaction, I continue to plant lucerne in beds, ſome with one, and others with three rows.

"The difference between the crop of 1756, and thoſe of the two preceding years, would induce one to think that rainy ſeaſons are beſt for the production of hay: but ſtill, the greater quantity which the year 1756 produced, muſt not be imputed to the rain only: we ſhould likewiſe conſider, that the plants had throve greatly ſince 1754; that their ſtems were grown much larger, and their roots much ſtronger and more numerous, and that they were conſequently able to yield much greater crops than before. They have abundantly anſwered my expectation, both as to quantity and quality.

"With reſpect to the quantity, it is much greater than that of any common fodder: I mean, of any that the ſame extent of ground would have produced, if cultivated in the common way, though it would then have been covered with an immenſe quantity of plants. This is a fact, which numbers of experiments prove, and which we ſhall ceaſe to wonder at when we conſider the great effects of the frequent ſtirring of the alleys. To this it is that I owe the repetition of my crops, and their being all of nearly equal goodneſs. I do not exaggerate when I ſay, that every ſummer month, which is the time I generally allow between each cutting, will produce ſhoots two feet long, and ſometimes more: and ſuppoſing that I cut them but five times a year, each plant will have produced after the rate of nine or ten feet length of ſhoots, and

that

that in the ſame time that moſt meadows will not produce graſs above two feet long.

"As to the quality of this hay, I continue to prefer it to all other fodder. My experience has confirmed what I ſaid of it in 1754; and I ſhall only add, that I have ſince found, that it is as good at the end of four years, as when it is firſt cut. If there was any difference, horſes would ſoon be ſenſible of it: but they eat of either without diſtinction.

"I feed my horſes with it, chiefly in the ſummer, at which time they do moſt work, and am more and more ſenſible of the advantages of it. Five or ſix pounds of lucerne a day, are ſufficient for a middle ſized horſe: but the quantity may be increaſed or diminiſhed, according as the horſe is nouriſhed by it; for in that there is great difference."

Experiments on the culture of Lucerne, *communicated to* Meſs. de Chateauvieux *and* Duhamel; *with an experiment made by* M. Duhamel.

IN April 1753, M. Diancourt ſowed lucerne in rows, of which many plants produced an ounce of hay a-piece in September following. In June 1754, the ſame plants yielded 12 ounces and a half each. He reckoned that, one with another, each plant had afforded him a pound of hay, which is a very great crop. On an arpent ſown in double rows, he had 26400 plants *; and on another ſown in ſingle rows, 15400 †: but whether the plants in the ſingle rows were ſo much

* A pound of dry hay from each of theſe plants, would amount to upwards of 13 loads of hay; equal to ten loads and a half on an Engliſh acre.

† At the ſame rate, theſe would produce about 7 loads and a half, at 18 hundred weight to the load.

larger

larger and more vigorous, as to compenſate for the greater number in the double rows, was what he could not determine at the time of his communicating this [a].

M. de Pontbriant, of Rennes in Britany, rightly judging that one of the moſt eſſential ſervices he could render to his country, would be the improving of the paſture of that province, which is famous for the production of cattle; planted lucerne, to ſhew the people how ſmall a ſpace of ground, and that too cultivated by the very cattle which are fed upon it, will produce a greater quantity of much better fodder, than all the graſs which their vaſt commons and extenſive paſtures yield them [b].

In September 1755, he tranſplanted lucerne from a field which was to be fallowed. The roots of the plants were three or four feet long. He planted them in beds ſix feet diſtant, and the plants eight or ten inches aſunder, in a field which he thought free from weeds. In this he was miſtaken: for, though the lucerne made very good ſhoots, yet, by neglecting to hoe the alleys, weeds came up, and over-run the ground.

He mowed the whole, then horſe hoed it, and planted a new row of lucerne between each of the former rows; and he expects that next year will yield him ſeveral good crops; which M. Duhamel thinks he may depend on, if he can but get the better of the weeds.

A gentleman at Montelimart in Dauphiny, writes as follows to M. de Chateauvieux [c].

"In the autumn, I tranſplanted from a ſpot of "lucerne three years old, as many plants as were

a DUHAMEL, *Culture des Terres, Tom.* IV. *c.* 1. ART. 3.
b *Ibid, Tom.* V. *c.* 1. ART. 15.
c DUHAMEL, *Culture des Terres, Tom.* V. *p.* 531.

"requiſite

"requiſite for a ſpace 96 yards ſquare, made into "beds. The middle of the beds was raiſed very "high, and I planted only a ſingle row in each. "The firſt cutting yielded me one truſs of hay; "the ſecond, four: the third, ſix. The ſhoots "of the laſt cutting were pretty tall, and ſeemed "to be deficient only in number: that, without "doubt, will come by and by, when the roots "ſhall have multiplied and grown ſtronger. I hope "that the heat of this climate will not ſtop their "growth: for I take care to ſtir the alleys as often "as the lucerne is cut.

"A little later in the ſeaſon, I planted 440 "yards more with lucerne, which I watered, be-"cauſe the weather was cold and dry. The plants "ſucceeded very well, excepting a few which "died. The firſt cutting was very weak; the ſe-"cond, middling; and the third is now growing, "it being but 17 days ſince the laſt was cut. "Several of the ſhoots are already 18 inches long. "I have not yet dunged any of theſe beds: but I "intend to dung them all next winter, in order "to quicken the growth of the plants, and give "them greater ſtrength."

The ſame gentleman writes again to M. de Chateauvieux, on the 12th of September 1755, to the following effect [b].

"I have already cut my lucerne in the new way, "five times, and hope to have a ſixth cutting "towards the end of this month. As the drought "does not cripple my plants, but only retards "their growth for about a week, I cut them at the "end of 25 days, when they were in full bloom: "whereas, in this ſeaſon, they require at leaſt a "month. The ſtalks are full as ſtrong, and the leaves "as large, as thoſe of other lucerne which is well

[b] *Ibid. p.* 532.

" dunged, and plentifully watered every fortnight.
" The only inconvenience I find, and that not a
" great one, is, that this lucerne is difficult to
" mow *, becauſe the ſtalks do not ſtand to the
" ſcythe, and many of them trail upon the ground.
" This year, I have uſed a ſickle; but it does not
" diſpatch the work ſo quickly as a ſcythe. Per-
" haps ſtirring of the alleys with the cultivator
" and plough, (neither of which I have uſed this
" year,) to clear the ground of weeds and looſen
" the mould, may help to ſtrengthen the ſtalks:
" and as they grow thicker every year, they will
" be better able to bear the ſcythe. I have pre-
" pared a great deal more ground, to enlarge my
" plantations of lucerne. The drought ſtops me
" for the preſent; but as ſoon as the rains ſhall
" have moiſtened the earth, I intend immediately
" to plant a ſurface of at leaſt one acre."

The following letter to M. de Chateauvieux, is dated from Chateau-Gaillard in the Upper Bugey, near Lyons, June 6, 1755[c].

" Lucerne which I ſowed laſt March, obſerving
" your directions in the culture of it, is now two
" feet high; which plainly ſhews me, that I ſhall
" be able to cut it ſix times next year. Some of
" my neighbours have ſown lucerne mixed with
" oats, in a better ſoil than mine, but without
" horſe-hoeing it, or ſtirring the ground between
" the plants. It is now but two inches high, and

* This inconvenience, ſays M. de Chateauvieux, is but a ſmall hindrance. I mow my lucerne, and it ſtands the ſcythe very well, eſpecially the ſecond year. A few trailing ſtalks which may eſcape the ſcythe, are of little conſequence; and expert workmen will leave but few, even of them. I have a plantation of lucerne which is always cut with a ſickle, though it would very well bear the ſcythe. This I do, that, by loſing none, I may be able to judge the more exactly of it's produce.

[c] *Ibid, p.* 536.

" is

" is in danger of being deſtroyed by the drought, " which mine is not."

A letter from the ſame, dated July the 5th, 1755, ſays[d].

" On the 20th of June, I cut my lucerne which " was ſown in March. It was three feet high when " I cut it, and has already made freſh ſhoots thir- " teen or fourteen inches long. I have let ſome " of it ſtand, which will produce good ſeed. This " will afford me an opportunity of convincing the " moſt incredulous, of the ſuperior excellence of " the new huſbandry."

This lucerne, after having been cut a ſecond time, was two feet high on the 17th of Auguſt: while that ſown in the old way, and mixed with oats, had not been cut at all, and was but four inches high.

M. Duhamel himſelf[e], in the autumn of 1755, took up the roots of an old field of lucerne, which were about the thickneſs of a man's thumb, and ſix or ſeven inches long, and replanted them in trenches. All his huſbandmen told him that they were worn out, and too old to ſhoot again: but yet not one of them failed. They yielded three cuttings the firſt year, though the ſoil was by no means proper for them. As there ſtill remained ſome rows which could not be tranſplanted in the autumn, he removed them the next ſpring. Many of theſe plants periſhed; and the ſhoots of thoſe which took, were much ſhorter than thoſe of what had been tranſplanted in the autumn. To repleniſh the empty ſpaces, he laid down ſome ſlips of the neighbouring plants, by which means he hoped thoſe chaſms would be filled up the next year.

This is a very ſimple and eaſy way to renew old paſtures of lucerne, and to have conſtant crops of

[d] *Ibid, p.* 538. [e] *Ibid, p.* 3.

this excellent fodder. Great care is requiſite, both in taking up the roots, and in planting them again.

An Engliſh Turbilly is conſpicuous in the foregoing experiments on the culture of ſainfoin in Yorkſhire; and another, of equal rank and title (much I regret the want of leave to publiſh the names of ſuch illuſtrious correſpondents), animated with the ſame noble zeal for the univerſal welfare of mankind, has honoured me with a letter from Lincolnſhire, dated the 3d of January of the preſent year 1763, in which he deſires to add the two following cautions, founded on his own experience, to M. de Chateauvieux's directions for planting lucerne, whenever that method is practiſed in this country.

" One is, always to plant it in good time, that " is to ſay, ſomewhat earlier than M. de Chateau- " vieux directs: the other, not to plant it on a " ridge; or, if you do, to make a deep trench on " the ridge, and, having buried your plants to " the neck, to leave a ridge on each ſide of them, " ſomewhat like what is done in the planting of " celery, in order that the mould may be drawn " to them when rain has ſaddened the earth, and " left perhaps an inch of the neck bare; becauſe, " for want of this, the firſt hard froſt may throw " them out of the ground, as happened to two " whole acres of my planting, in the year 1761. " I took all the precautions adviſed by M. Du- " hamel, but planted my lucerne on ridges, or " little lands, three feet wide. The ſoil was in " good order; having been very well plowed and " manured, and being naturally light. Heavy " rains, which fell before Chriſtmas, waſhed a " great part of the light earth down into the " furrows; and in the ſpring of 1762, repeated

" ſnows

"ſnows and froſts looſened the ground to ſuch a "degree, that the whole crop was thrown out "of it.

"This year (1763), I have a better proſpect; "owing, I think, to my having made uſe of the "above precautions. The wet has waſhed the "little ridges down to the plants, and I hope they "will not be hurt by the froſts: though, when the "ſeaſon will permit, I ſhall have all the roots earth-"ed up, and trodden *.

"Laſt ſummer was the ſecond year of a quan-"tity of lucerne that was ſown on a light pooriſh "ſoil, in drills three feet diſtant from each other: "yet, though the ſeaſon was very dry, and re-"markably bad for all ſorts of graſs, I cut it four "times, and the ſtalks were, at each cutting,

* My letter to this diſtinguiſhed patriot, requeſting to be informed of the farther ſucceſs of theſe plants, ſeems, unfortunately, not to have reached him; for I cannot impute to any other cauſe, the ſilence of a gentleman whoſe noble ſpirit induced him to communicate theſe judicious remarks, purely for the public good, and who was, moſt obligingly, pleaſed to promiſe me his obſervations on other intereſting parts of the huſbandry practiced in Lincolnſhire. I therefore take this method of returning my ſincere thanks for the favour already conferred; and hope that the public, whoſe welfare he has ſo evidently at heart, will not continue to be deprived of his excellent inſtructions. Happy ſhall I eſteem myſelf in being the channel through which my country may be benefited! and I cannot but indulge the pleaſing expectation, that the truly intelligent, the wiſhers of the real happineſs of mankind, will, animated by the fine examples now ſet before them, think it the duty of an Engliſhman to contribute to the permanent glory of this happy kingdom, by imparting to the world ſuch improvements in any of the various branches of huſbandry, as have come to their knowledge: for, it cannot be too often repeated, agriculture is the ſource, and ſolid foundation, of the proſperity of nations. Our rival neighbours are ſo ſenſible of this important truth, that even their nobility, take a laudable pride in prefixing their names to experiments in huſbandry, and in being real patrons of this art. Let us then, here learn from them. *Fas eſt et ab hoſte doceri.*

" except the laſt, from eighteen inches, to two " feet, long.

" I found my horſes very fond of it, though not " ſo much as to prefer it to all other ſorts of food. " Trefoil, for inſtance, ſeemed to pleaſe them as " well; and they could eat much more of it: for " they are quickly ſtalled with the lucerne, though, " after reſting half an hour, they fall to again, " very greedily.

" I have ſown ſome lucerne in Mr. Rocque's " method. It promiſes fair, but has not yet been " cut; being ſown only laſt April. I am con- " vinced that it will not be killed, or even much " damaged, by being well harrowed, or even " plowed: for, ſome chance roots which grew in " the intervals between my rows of drilled lucerne, " were hoed over with the horſe-hoe many times " laſt ſummer, were often laid bare ſix inches " deep, and yet have been ſo far from being de- " ſtroyed, that they have conſtantly had flouriſhing " tops. If the weeds can be kept from growing " ſo as to do much harm, by his method, I am " ſatisfied that it will be the beſt: horſe-hoeing " being a conſiderable trouble, and ſo much out " of the common way, as not to be likely ever to " become general."

Excepting ſome parts of what has already been ſaid, M. Duhamel's Elements of Agriculture contain little more than the following heads relative to the culture of this very uſeful plant.

He thinks[f] it will be right to dung the lucerne the third year after it has been planted; never to overflow it, where that can be done, unleſs the ſeaſon be exceſſively dry, and even then to let in the water very ſparingly, and for a very ſhort time only; and not to let any cattle feed upon the

[f] *Eléments d'Agriculture, Tom.* II *Liv.* 9. *c.* 2. Art. 1.

plants

plants where they grow, if it be intended that they ſhould laſt long. He obſerves that, if it be much wet in the field after it has been mowed, it's leaves will turn as white as paper in a few days; but that, if it be only a flying ſhower, which has penetrated no farther than the ſurface, the beſt way is not to touch the ſwarths till the wind has dried them. In very hot weather, this hay muſt be houſed before it is quite dry; or the greateſt part of it's leaves will fall off, and be loſt. He is clearly of opinion, that it cannot be kept long in ſtacks, in the open air, unleſs thoſe ſtacks are thatched very thick, with good ſtraw, to turn off all wet: and after mentioning the practice of ſome farmers in France, who, if they ſtack their lucerne before it is thoroughly dry, leave a hole down through the middle of the ſtack, as will hereafter be directed for hay, to prevent it's heating, he adds, as a much better method, that of others, who, when obliged to houſe this hay earlier than they would wiſh, lay it and ſtraw in alternate layers, in their barns. The ſtraw, thus placed, preſerves the lucerne from heating, and contracts a fine ſweet ſmell, ſo pleaſing to horſes, that they eat it with appetite when given to them in the winter, mixed with the lucerne.

M. Duhamel aſſures us, from his own experience, that this fodder, cut before it had bloſſomed, and given green, has reſtored young horſes which had fallen away and loſt their fleſh, when no cauſe could be aſſigned for their decay; and that cows fed with it, yield an extraordinary quantity of excellent milk. He holds it to be moſt excellent food for every kind of cattle, horſes, oxen, cows, ſheep, all of which are fond of it, either green or dry. It's only fault, ſays he, is, that it is too nouriſhing when dry, and that cattle, if let alone, will then eat of it till they ſwell and

burſt themſelves. But this is eaſily prevented, by ſtinting them to a proper allowance, with which they will hardly ever fail to fatten and grow ſtrong.

M. Duhamel concludes this article with obſerving, that, in ſome years, ſwarms of black caterpillars are apt to breed in the lucerne, and to eat up all it's young ſhoots: to prevent which miſchief, he rightly adviſes cutting it down as ſoon thoſe enemies begin to appear; becauſe they will thereby be deſtroyed, and the plants will ſoon ſhoot out anew; generally without any damage to the enſuing crop.

ARTICLE IV.

Of the Cytisus.

WHETHER this plant, which was highly eſteemed by the ancient Romans, ought, by us, to be looked upon as a ſhrub-trefoil, or a ſhrub-lucerne; or whether we ſhould call it, as Tournefort does, *Medicago trifolia, fruteſcens, incana*, ſhrubby, hoary, three leaved *medicago*, and accordingly, with Mr. Miller[a], claſs it as a ſpecies of medic; belongs to botaniſts to determine, and not to this work. Mr. Miller, who has taken ſome pains to diſcuſs this queſtion, is ſatisfied that the *Cytiſus* of Virgil, Columella, and all the old writers on huſbandry, is this *medic*, to which he allows every quality that can recommend it for the feeding of cattle in the countries where it grows naturally, ſuch as the iſlands of the Archepelago, Sicily, and the warmeſt parts of Italy; but is perſuaded that it will not thrive in England, ſo as to be of any real advantage for that purpoſe here; be-

[a] *Gardener's Dict.* Art. MEDICA.

cauſe

cauſe it cannot bear ſuch hard froſts as we ſometimes have, or, if it does bear them ſo far as not to be abſolutely killed, it will be ſo much damaged thereby, as not to be able to recover it's verdure before the middle or latter end of May; nor even then to put forth ſhoots that will bear cutting more than once in a ſummer; beſides their being ſo woody, if ſuffered to grow to any conſiderable length, as to render that cutting very troubleſome, and of little ſervice by way of fodder. He therefore thinks that, upon the whole, it can never anſwer the trouble and expence of cultivation in this country, where we have very many other preferable plants; but that, in hot dry rocky countries, of which we now have ſeveral in our colonies, where few other vegetables will thrive, (and therefore it is, chiefly, that I mention it here), this may be cultivated to great advantage; for it will live there many years, and proſper well.

Columella [b] and Pliny [c] were, however, of a different opinion from Mr. Miller, in regard to the hardineſs of this plant, which, ſay they, will not only thrive in the very pooreſt ſoil, but will likewiſe endure almoſt all injuries; among which they could not but mean froſt, as it is well known that moſt parts of Italy, notwithſtanding their heat in the middle of the day, and the ſame holds good with reſpect to other countries ſimiliar in that reſpect, are liable to very keen froſts, which come on ſuddenly, and are, for that very reaſon, far more dangerous to all ſorts of vegetables, than thoſe which, though much more intenſe, and of far longer duration, come on more gradually. I therefore cannot but incline to think, that Mr. Miller may be miſtaken here.

b *De Re ruſtica, Lib.* V. *c.* 12.

c *Natural Hiſt. Lib.* XIII, *c.* 24.

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This plant riſes to the height of five, ſix, or even more, feet, with a ſhrubby ſtalk covered with a grayiſh bark, and divided into many branches, covered with a hoary down while they are young, and garniſhed at each joint with trifoliate leaves ſtanding upon footſtalks about an inch long. There are two or three of theſe at each joint, ſo that the branches are cloſely covered with them. The lobes are ſmall, ſpear-ſhaped, and hoary on their under ſide, and theſe leaves remain all the year. The flowers, which are of a bright yellow, blow on footſtalks which ariſe from the ſide of the branches, each footſtalk ſuſtaining four or five flowers; and theſe are ſucceeded by compreſſed moon-ſhaped pods, each containing three or four kidney ſhaped ſeeds.

The Cytiſus may be raiſed either from it's ſeed ſown about the middle of October, or in the beginning of April, or, if greater ſpeed be deſired, from cuttings, ſlips, or layers, planted in the ſpring or autumn, ſo as to leave a ſpace of four feet between every plant. Such are the directions of Columella, who adds, that if the ground be well dunged for this planting, and hoed up around the plants, which ſhould be watered during the firſt fortnight, if rain doth not fall, plentiful crops may be obtained of this excellent vegetable, equally fit for horſes, oxen, cows, ſheep, hogs, goats, and poultry, and ſingularly profitable for bees, whoſe honey it increaſes prodigiouſly. It has the ſame effect on the milk of cows, beſides greatly improving it's quality. In the kingdom of Naples, the goats feed upon it, and great quantities of excellent cheeſe are made of their milk. In the iſlands of the Archipelago, the Turks make handles for their ſabres of the wood of this ſhrub, which, when full grown, is as hard as ebony, and of a fine yellow colour. It will bear cutting as often as

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it's ſhoots are about fifteen or eighteen inches long, which may be ſeveral times in the year; for it ſhoots and flowers during eight months in countries where it grows well, and continues green during the whole winter, if that ſeaſon be at all favourable. It's ſeeds begin to ripen towards the end of Auguſt, and continue ſo to do till the cold ſtops them. It will be fit for cutting at the end of three years at fartheſt, and ſhould be carefully kept clear of weeds, and hoed up between each cutting. If given as green fodder, which it affords during eight months of the year, as before ſaid, about fifteen pounds weight of it are enough for the daily food of a horſe, twenty pounds for an ox, and ſo in proportion for other cattle, according to their ſize and ſtrength. When made into hay, it ſhould be given more ſparingly, becauſe it is then more nouriſhing. In this ſtate, it ſhould be ſteeped in water before it is given to cattle, and then be mixed with chaff or ſtraw. The time of cutting it for hay, is when the greateſt part of it's ſeeds begin to grow big; and the manner of making this hay is, to let the ſwarths lie ſome hours in the ſun, till they are faded, and then to dry them thoroughly in the ſhade [d].

ARTICLE V.

Of Burnet.

THE public owes the improved culture of this plant, the *Pimpinella* of Linnæus, the *Tragoſelinum* of Tournefort, the *Pimprenelle*, or *Boucage*, of the French, and a native of our country, which promiſes very great advantages, to the laudable purſuits of the Society for the Encourage-

[d] Columella, *ubi ſupra*.

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ment of Arts, Manufactures, and Commerce, in queſt of a green and ſucculent food for cattle during the winter months: but more immediately to the judicious obſervation of Mr. Rocque, already mentioned, who, remarking that Burnet retains it's verdure amidſt all the inclemencies of that ſeaſon, reſolved to try the effect of giving it a good culture. He has ſucceeded therein to his utmoſt wiſh; and I may congratulate him on the immortality of his name, wherever this uſeful plant ſhall be duly attended to. Three years have have not yet enabled him to publiſh to the world an account of the beſt method of treating it, vouched by proper experiments: but he intends to do this as ſoon as he ſhall be ſufficiently informed. It bids fair to be of ſingular utility where flocks of ſheep are kept, becauſe, as it preſerves all it's leaves unhurt by froſt, the farmer may thereby have a conſtant ſtock of green food for his ewes and lambs, at a time when turneps and every other ſucculent plant may fail him. On this account, I would ſtrongly recommend the culture of this healthy ever-green, particularly to all ſuch farmers: for that it, probably, will ſtand the rigour of the ſharpeſt winter, appears plainly from it's not having been ſenſibly impaired in any reſpect by the ſevere and long continued froſt in December and January laſt.

In deſcribing this plant, Mr. Miller diſtinguiſhes[g] ſeven different ſpecies of it; but only three, or perhaps rather but two, of them ſeem to be the ſorts proper to be cultivated for the food of cattle. Theſe are 1. The *Tragoſelinum majus, umbellâ candidâ*[h], Greater *burnet* ſaxifrage with a white umbel; 2. *Tragoſelinum alterum majus*[i],

[g] *Gardener's Dict.* Art. PIMPINELLA.

[h] TOURNEFORT, *Inſt. R. H.* 309. [i] *Id. ibid.*

another

another greater *burnet* ſaxifrage; and 3. The *Tragoſelinum minus* [k], or leſſer *burnet* ſaxifrage. All theſe are equally hardy plants, and natives of this iſland: but the largeſt ſorts promiſe the greateſt quantity of fodder, and therefore ſhould, probably, be preferred by the husbandman. A fourth ſort, which Mr. Miller mentions by the title of *Tragoſelinum radice nigrâ Germanicum* [l], German *burnet* ſaxifrage with a black root, will probably anſwer as well in it's native country, Germany, as our's will here; and I therefore recommend the trying of it there; as I do to other countries, the cultivating of their native ſpecies of this plant, in full confidence that they will find it anſwer greatly for the winter green food of their cattle. Experience has proved that all countries are benefited by the introduction of foreign plants, as particularly the lucerne, ſainfoin, &c. I therefore take this opportunity of recommending a trial of the German burnet here, and of our's in Germany and elſewhere.

The firſt of the above-mentioned ſpecies of burnet grows naturally in woods, and on the ſide of banks near hedges, in ſeveral parts of England. The lower leaves of this ſort are winged, and compoſed of three pair of heart-ſhaped lobes, terminated by an odd one: they are ſharply ſawed on their edges, and ſit cloſe to the mid-rib. The lower lobes, which are the largeſt, are near two inches long, and one and a half broad at their baſe, and are of a dark green. The ſtalks grow more than a foot high, dividing into four or five branches; the lower part of the ſtalk is garniſhed with winged leaves, ſhaped like thoſe at the bottom, but ſmaller; thoſe upon the branches are ſhort and trifid; and the branches are terminated

k *Id. ibid.* l JUSSIEU. HORT. CHELS. CAT. 100.

by

by ſmall umbels of white flowers, which are compoſed of ſmaller umbels or rays. The flowers have five heart-ſhaped petals which turn inward, and are ſucceeded by two narrow, oblong, channeled ſeeds. It flowers in July, and the ſeeds ripen in autumn. A variety of this with red flowers, is frequently found among the other, and riſes from the ſame ſeed.

The ſecond ſort grows naturally in dry paſtures in many parts of this iſland. The lower leaves of this are compoſed of four pair of lobes, terminated by an odd one: theſe are roundiſh: thoſe on the lower part of the leaf are about half an inch long, and the ſame in breadth: they are indented on their edges. The ſtalks riſe near a foot high and ſend out three or four ſlender branches, which are garniſhed with very narrow leaves. The umbels of the flowers of this are ſmaller than thoſe of the former ſort, as are alſo the flowers and ſeeds, which blow, and ripen, about the ſame time.

The third, or ſmaller, ſort of burnet grows naturally in dry gravelly paſtures in ſeveral parts of this country. It's lower leaves have five or ſix pair of lobes terminated by an odd one, and are deeply cut almoſt to their mid-rib, in form of wings. The ſtalks are ſlender, and riſe about a foot high, ſending out a few branches which have a narrow trifed leaf placed at each joint, and are terminated by ſmall umbels of white flowers compoſed of ſeveral rays ſtanding upon pretty long foot-ſtalks. The flowers of this ſort appear, and it's ſeeds ripen, at the ſame time as thoſe of the former; but they are ſmaller.

That I may go through the uſeful part of Mr. Miller's deſcription of the ſeveral ſpecies of this plant, I muſt here mention, becauſe the culture of it may poſſibly turn to advantage in ſome of

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our warm colonies, Linnæus's *Pimpinella foliis radicalibus trifidis inciſis* [m], Pimpinel with trifid cut lower leaves, which is the *Aniſum vulgare* [n], or common Aniſe. This is an annual plant, which grows naturally in Egypt, but is cultivated in Malta and Spain, from which countries it's ſeeds are brought annually to England, where a water is diſtilled, and an oil drawn, from them, for medicinal uſes. Our paſtry-cooks and confectioners, alſo make great uſe of theſe ſeeds in ſeveral of their compoſitions, to give them an aromatic taſte and ſmell. The lower leaves of this ſort are divided into three lobes, which are deeply cut on their edges. It's ſtalks riſe about a foot and a half high, and divide into ſeveral ſlender branches, which are garniſhed with narrow leaves cut into three or four narrow ſegments, and are terminated by pretty large looſe umbels, compoſed of many ſmaller umbels or rays, which ſtand on pretty long foot-ſtalks. The flowers of this ſpecies, which are ſmall and of a yellowiſh white, appear in July, and are ſucceeded by oblong ſeeds, which ripen in autumn, even here, if the ſeaſon prove warm. The time for ſowing them is the beginning of April; and the place, a warm border of fine mould where the plants are to remain. Thinning them after they are come up, and keeping them clear of weeds, are the only culture which this plant requires: but it is too tender to be cultivated in England, for profit.

I therefore return to the far more uſeful, and conſequently more valuable, ſort of burnet, namely, the larger ſpecies, concerning which the following are the chief directions which Mr. Rocque's experience has hitherto enabled him to give. The obliging readineſs with which theſe have

m *Sp. Plant.* 264. n CLUS. *Hiſt.* 2. *p.* 202.

been

been communicated, for they never before appeared in print, entitles the author of them to my particular thanks, and ſhews him to be happily poſſeſſed of that laudable ſpirit, which diſdains all ſelfiſh views, when the welfare of the public is concerned.

In the meadows about Windſor, half the graſs is burnet. M. Rocque has experienced, that it will grow in the drieſt land: for he has planted ſome of it even in the gravel walks in his garden, where every thing elſe is burnt up in the ſummer; but this never withers: one of the qualities of burnet being to continue in ſap all the year. It is the opinion of many who have ſeen the burnet of his raiſing, that if this plant is generally cultivated, there will never be a ſcarcity of hay in England, even in the greateſt drought.

The land on which it is ſown ſhould be in fine tilth, and free from weeds, eſpecially couch-graſs, which is here the moſt hurtful of all. A drag, that is to ſay, ſuch a fork as the gardeners clean their aſparagus with, is the beſt inſtrument for extirpating this weed. The dragging of an acre thus will coſt ſix or ſeven ſhillings. If the land is poor, it ſhould be dunged, and laid down very ſmooth. The ſeed may be covered with a very light harrow, for it will not bear to be buried deep, and the ground ſhould then be rolled, that it may be ſmooth for mowing. It may be ſown at any time between April and September.

A thought occurs to me here, which I mention, though it is hitherto unſupported by facts. — If the ſeeds of plants which do not arrive at their perfection in a few months, or during the firſt year, ſuch as lucerne, ſainfoin, and burnet, are ſown in the ſpring, or beginning of ſummer, and the weather prove dry, or cold; the young plants are often crippled or deſtroyed: but if they are

ſown

ſown in the latter end of July, or beginning of Auguſt; the rains frequent at that ſeaſon, the heavy dews which fall, and the increaſing coolneſs of the nights, often bring them as forward by the latter end of November, as thoſe ſown in April. Or M. de Chateauvieux's practice of having a nurſery, from whence theſe plants may be tranſplanted in Auguſt or September, may be the moſt ſecure and ſucceſsful method of cultivating them; becauſe they can then be ſet at whatever diſtance is thought moſt proper, and may by that means be moſt eaſily preſerved from weeds, by hoeing, or otherwiſe. Indeed the quick and buſhy growth of burnet, by which it ſoon covers all the ground, is, of itſelf, an almoſt effectual bar to weeds.

Though Mr. Miller does not aſſign this reaſon, yet his directions for ſowing many ſeeds in Auguſt, rather than in the ſpring, are an indication, that this practice is founded on reaſon. Mr. Rocque's advice, to prefer July or Auguſt for the ſowing of burnet, ſhews that he alſo had obſerved the advantages of ſowing at this ſeaſon.

Ten pounds of burnet ſeed may do for an acre of land: but twelve, fourteen, or even ſixteen, pounds will be better; becauſe, when burnet is thin, the plants grow ſo large, that the hay made of them is coarſe. Theſe will riſe in eight or nine days after the ſowing. If great numbers of weeds come up with them, it will be leſs chargeable to let thoſe weeds grow with the burnet, till it is about five or ſix inches high, than to weed or hoe it. The whole may then be mowed, and gathered clean off; and the quick growth of the burnet afterwards will choak all other weeds. The heart of the burnet being almoſt within the ground, the ſcythe cannot hurt it.

If the burnet does not grow equall every where, ſome plants muſt be drawn where they are too

thick, and planted where they are thinneſt: or the vacant ſpaces may be ſupplied from the nurſery before mentioned. If the land was not got in good order to ſow the ſeeds at a proper ſeaſon, the burnet may be tranſplanted at Michaelmas from this nurſery, and ſet at nine or twelve inches diſtance every way, according to the richneſs of the ſoil.

The ſeed ſown in May may be mowed at the latter end of July. That ſown in June will yield a pretty good crop, and muſt be cut but once; and the ſame of that which is ſown in July. The plants produced by the ſeeds ſown in Auguſt ſhould be mowed, to deſtroy the weeds. Theſe mowings may either be given green to horſes, or be made into hay. The firſt ſpring cutting will purge horſes; and Mr. Rocque believes it will alſo cure the greaſe: but it is only the firſt crop that purges.

Burnet ſhould be mowed but once the firſt year, in order to leave it rank in the winter; and in this caſe it will be ready to feed in February or March, or to mow again in April.

If natural graſs grows among the burnet, it may be harrowed in the ſame manner as lucerne; for, having a tap-root, the harrow will not hurt it: but it muſt not be plowed, leſt the roots ſhould be broken in the ground.

When the ſeeds of this plant are to be ſaved, it muſt neither be fed, nor mowed, in the ſpring. The ſeed will be ripe about the middle of June, when it muſt be reaped, like wheat, and threſhed on a cloth. It ſhould be threſhed before it is too dry, becauſe it is apt to ſhed, and it ſhould afterwards be dried perfectly.

Burnet does not loſe it's leaves in drying; and though the hay made of it be ſticky, it will, after threſhing, be very agreeable to horſes, which are ſo fond of it, that they never waſte any. One acre will produce upwards of three loads of hay, and above

above forty buſhels of ſeeds. Horſes are fonder of this ſeed, than they are of oats: and Mr. Rocque is of opinion that it is a more proper food for thoſe that do not labour hard, becauſe it is not of ſo hot a nature. Burnet bears ſeed twice a year, and will afterwards yield a very good ſpring crop.

It is not only good for horſes, but alſo for all manner of cattle; even for ſwine: and Mr. Rocque has experienced another virtue in it, which is, that, being ſtung by a waſp, the leaves of this plant rubbed pretty hard upon the part ſo injured, immediately took off the inflammation.

Mr. Worlidge mentions [a] as another excellent quality of this plant, that all good houſe-wives hold, as an infallible rule, that there never need be bad cheeſe or butter, but eſpecially cheeſe, where ſaxifrage grows: "from whence, adds he, "it cometh, that the Netherlands abound much "in that commodity, and only, as is ſuppoſed, "through the plenty of this herb."

Mr. Rocque's burnet, from the ſquareneſs of it's ſeeds, ſeems to me to be the *Pimpinella ſanguiſorba* of Mr. Ray, who diſtinguiſhes [b] two ſpecies of this plant, *viz.* the *Pimpinella minor hirſuta*, ſmall hairy burnet, which I take to be the firſt ſpecies of Mr. Miller's *Poterium*; and the *Pimpinella ſylveſtris major ſanguiſorba*, great burnet, which is Mr. Miller's firſt ſpecies of the *Sanguiſorba*. The ſmall oblong ſeeds of burnet are thoſe of Mr. Miller's firſt ſpecies of the *Pimpinella ſaxifraga*, which is Tournefort's *Tragoſelinum majus*. Mr. Ray obſerves, that the firſt of theſe ſorts grows naturally in dry chalky paſtures, and the latter in wet meadows. He likewiſe deſcribes a large ſpecies of burnet, which is a native of America, and which reſembles our's in every reſpect.

[a] *Syſtema Agriculturæ*, p. 32.
[b] *Hiſt. Plant. Tom.* I. *Lib.* 9. *c.* 11.

CHAP. III.

COMPARISON OF THE OLD HUSBANDRY AND THE NEW.

IT is now that, having treated fully of the culture of the ſeveral ſorts of plants which either are, or may be, profitably raiſed in the field, for the food of men, or cattle, or which may be benefited by horſe-hoeing, though perennial; we may, with propriety, take a comparative view of the old huſbandry and the new. As this is an object of the greateſt importance, not only to the huſbandman, as an individual, but to the nation in general; I hope to be excuſed, if I recapitulate ſome parts of what has been already ſaid.

Many gentlemen, in this kingdom, have raiſed wheat in drills, horſe-hoeing the alleys; and, where due care has been taken, generally with ſucceſs. The grain has, in almoſt all inſtances, been larger and better than that in the broad caſt way, and ſeldom leſs in quantity. Sometimes it has been much more; as Mr. Miller notices very remarkably, when he aſſures us of his being informed by perſons of great credit, that even twelve quarters of wheat have been reaped from an acre of land drilled and managed with the horſe-hoe [a]. —But this is ſuch a crop, as I ſhall not attempt to reaſon upon. He is more within the bounds of moderation when he ſays [b], that he himſelf has known eight or ten quarters reaped from an acre, over the whole field, and ſometimes more: though I ſhall not form my calculations even from theſe extraordinary crops.

a *Gardener's Dict.* Art. TRITICUM. b *Ibid.*

I am

I am ſorry to obſerve, that, though I have been honoured with many letters in commendation of the plan of this work, and, if I might be allowed to ſay it without the imputation of two much vanity, even not diſapproving of the execution of what has hitherto been publiſhed; only thoſe three of my countrymen whoſe experiments on ſainfoin and lucerne I have given in the preceding chapter, have, as yet, ſuffered their love of the public weal to prevail ſo far as to induce them to impart any account of their improvements in husbandry. — To what ſhall I impute this alarming deviation from thoſe ſentiments which uſed glorioufly to diſtinguiſh the Britiſh nation? from thoſe ſentiments which animated a Bacon, a Hartlib, a Platt, a Worlidge, an Evelyn? Illuſtrious men! immortalized by the ſervices thereby rendered to their country. — Is it, that few among us now attend to the ſtudy of agriculture? —Has our unbounded commerce, and the vaſt opulence accruing therefrom, unfortunately rendered the Engliſh leſs attentive than they were, and ever ought to be, to this moſt genuine, and inexhauſtible, ſource of their proſperity?—— Have the extraordinary eaſe and affluence of the preſent inhabitants of this iſland, unhappily contributed to render them leſs ſenſible than heretofore, to the general duties of Society? — Far different is the caſe of thoſe admirable lovers of their native land, the free and brave inhabitants of Swiſſerland, whoſe affection for their dear country, as they conſtantly call it, ſhines in every page of the very uſeful Memoirs of their laudable Society at Berne.

It is judiciouſly remarked by the gentleman who favoured me with the foregoing account of his culture of ſainfoin in Yorkſhire, that " M. de " Chateauvieux's experiments are very exact, and " ſeemingly concluſive: but that, beſides their

" being made in a climate very different from " our's *, the great ſuperiority which the new huſ- " bandry, as it is called, appears by them to have " over the old, may, and probably is, in ſome " meaſure, owing to the bad manner of farming " which prevails generally in his country: for " that, according to his own account, their lands " lie fallow every third year, and they ſow too " great a quantity of ſeed: whereas, if the juſt " proportion were obſerved, according to the na- " ture of the ſoil; and if a crop was taken every " year, by the introduction of turneps and clover, " or by otherwiſe diverſifying the crops, as is " known to be the conſtant practice in many parts " of England; a double advantage would proba- " bly accrue to the farmer, and then the compa- " rative excellence of the horſe-hoeing method, " as ſtated in his own account, might not be very " great. Mr. Tull, (to whom I think his country " greatly indebted for ſtriking out a new path " which may in ſome circumſtances be followed " with great advantages) is certainly a prejudiced " writer, and too much attached to his own " ſyſtem. His book firſt induced me, ſome years " ago, to try the horſe-hoeing method, which I " have continued ever ſince, and have applied to " many plants of different kinds. Theſe trials have " been attended with various ſucceſs: and though " I dare not take abſolutely upon me to ſay, that " every farmer would find it more profitable than " the way he was brought up in, yet will I ven- " ture to promiſe any gentleman, who, with " knowledge of the principles, and judgment,

* I muſt here beg leave to obſerve, that, if we reflect on the cold air deſcending from the Alps, ſo many months covered with ſnow, and on the extreme heat of the ſummer's ſun, we ſhall, perhaps, find the climate in this kingdom full as favourable to vegetation.

" and,

" and, let me add, ſome reſolution to withſtand " vulgar prejudices, ſhall attempt the horſe-hoeing " husbandry, that he will be amply rewarded by " the entertainment which this kind of culture " affords; and the ſuperior ſize and excellency " which many plants will arrive at by horſe-hoe- " ing, will ſurpriſe him. I know no vegetable " that proves this more fully than the turnep; " conſequently none fitter to begin experiments " on."

The gentleman to whom I owe the preceding account of his management of lucerne in Lincolnſhire, adds, after the quotation before given * from his very ſenſible letter. " You will perceive " that I have entered deeply into the drill and horſe- " hoeing husbandry. —— I took a great deal of " pains with wheat, ſowing three rows of it in " lands five feet and an half broad, where it was " horſe-hoed ſo much that the ground became " abſolute duſt. The corn grew very ſtrong and " fine, and the ears were large and well filled. " However, at harveſt, I had only ſeventeen ſhocks " on an acree, whilſt in ſome ground cloſe to it, " ſown in the common way, I had 23 to an acre; " but the ſtraws were ſmaller, and the ears not ſo " well filled. I believe that, ſhock for ſhock, " the drill was the beſt; but acre for acre, the " ſown corn. I have ſown my intervals, however, " again with wheat, and have drilled ſome freſh " lands."

Both theſe gentlemen, and another, the atchievements of whoſe illuſtrious anceſtors grace the annals of the Engliſh hiſtory, but who likewiſe deſires to conceal his name on this occaſion, have favoured me with ſome very judicious remarks on the inſtruments uſed in the new husbandry: but

* Page 276—278.

as they did not come to hand till after that part of my work was printed off, I ſhall give them in an appendix, with whatever elſe, properly pertinent to the ſubject of agriculture, may be communicated to me, before the publication of that laſt part.

Moſt of the experiments related in the ſecond volume of this work ſhew, that, taking them only as ſingle crops, they were equal to thoſe ſown in broad caſt, and raiſed at a much leſs expence, if we conſider the ſaving in ſeed and manure: but if the produce of the ſame land is taken for ſeveral years running, the advantage is greatly in favour of the horſe-hoeing husbandry, in which the land, being never reſted, brings a conſtant yearly return to the farmer. This difference will appear very conſiderable if we reckon, on the other hand, the loſs of a crop, and the expence of a fallow. And another thing to be ſaid in favour of the new method, is, that no perſon has yet continued it long enough, or made a ſufficient variety of experiments, fully to aſcertain it's value. This appears from the conſtantly repeated variations of that moſt judicious experimenter, M. de Chateauvieux; who yet declares, that he was not fully ſatisfied, of what breadth to make the beds, in what manner to ſow the rows, or what quantity of ſeed it is moſt proper to uſe. Theſe facts are ſo evident in many of his experimenter, that I need only refer the reader to the calculations there given; for it would be needleſs to repeat them here.

Some farmers may object, that it would be wrong to attempt to render the practice of the horſe-hoeing husbandry general; becauſe it ſeems more than probable that the common broad caſt way will do better for ſome plants, which, as they remain but a ſhort time on the ground, grow thereby as perfectly as their nature admits of,

pro-

provided the land was in fine tilth and good heart when they were ſown. The worthy gentleman before mentioned in Lincolnſhire, confirms this by his own experience. "I tried barley twice, "ſays he, in the horſe-hoeing way, without any "ſucceſs; and oats the ſame: that is, I did not "get ſo much corn by a conſiderable deal, as "in the common way*." But I muſt here obſerve, that the raiſing of theſe in the old way need not be a bar to the new husbandry; becauſe the land will be fit to lay down in beds, for other plants, as ſoon as theſe are taken off, if it was in good order before.

What will infinitely enhance the importance of this husbandry, is the advantage which may ariſe from a judicious change of crops; an object which, unfortunately, has eſcaped the notice of that attentive obſerver, M. de Chateauvieux: this kind of husbandry not having been introduced into his country. — He was ſo intent on trying what land would do with thorough plowing alone, that though he raiſed plants very different in their manner of growing, yet he did not think of raiſing them interchangeably on the ſame ſpot. Had this thought occured to him, that clearneſs of judgment, and depth of penetration, with which he ſaw the advantageous conſequences of every ſubject, would, undoubtedly, have befriended us greatly here.

Many writers have been of opinion that changes of crops are of eſſential ſervice to the land, becauſe, ſay they, each plant aſſumes, for it's nouriſhment, that part only which is proper for it's own particular food, without impoveriſhing the ground for any other plant. — Though I can hardly ſub-

* I have, however, ſeen plants of oats which grew by accident in a bed of wheat, have a great number of ſtalks and ears, and a ſurprizing number of grains in each ear.

ſcribe to this opinion, yet, as real experience may have taught them a fact upon which they, perhaps, have have reaſoned falſely, by aſcribing to the aſſimilation of particular juices only, what is more probably owing to the different effects which different roots may have on the ſoil; I make no doubt but that a judicious change of crops may be of proportionably greater advantage in the new husbandry, as, in this method, weeds, thoſe obſtinate and frequent enemies to the husbandman, can never get a head, but the land will be conſtantly preſerved in good order. In ſhort, it is only extending over the whole kingdom, what we daily ſee practiſed in the garden grounds around London: and it is more than probable, that equal culture will be attended with equal ſucceſs, in every place.

M. de Chateauvieux's experiments prove, that manure is not ſo eſſentially neceſſary towards obtaining plentiful crops, as it is generally ſuppoſed to be; and that the plants cultivated chiefly by thorough plowing, are rather ſuperior to thoſe raiſed in well dunged fields: though I will not go ſo far as ſome have done, when they alledge, that plants acquire, not only a diſagreeable reliſh (in which they are certainly right), but even ſomething hurtful, if not poiſonous, from dung [c].

This change of ſpecies becomes the more adviſeable, when we reflect, that a crop of ſome of the before mentioned roots is of equal, or rather ſuperior, value to a crop of wheat: and this again will ſtrike us yet more ſtrongly, if we conſider the quantities produced on an acre of land, and how far they will go in the feeding and fattening of all kinds of cattle. The inhabitants of Britany, from a confirmed experience of their uſe, reckon, as was obſerved before, a full crop of parſneps equal in

[c] See TULL's *Horſe-hoeing Huſbandry*, c. 4.

value

value to three middling crops of wheat: and that they do not err in this eſtimate will appear very probable, if we make, in the ſame light, a calculation grounded upon the ſucceſs of M. de Chateauvieux's experiments on carrots; eſpecially as parſneps grow to a larger ſize, and are at leaſt equally ſubſtantial food.

I will ſuppoſe, for example, five quarters of wheat to be reaped from an acre of land; a crop which not one acre in ten yields throughout England; and I will eſtimate this at the parliamentary price of 3s. 6d. a buſhel; that is to ſay, 28s. a quarter; this being the price below which our government grants a bounty on exportation. At this rate, the produce of the acre will be worth ſeven pounds. — The difference between the price of a lean bullock, and that of a fat one, cannot, upon a medium, be leſs than three pounds. Now a bullock may be completely fattened in three months, at fartheſt; and as experience has ſhewed that it can eat two hundred pounds of turneps in a day, I will allow daily one hundred pounds of carrots, or parſneps, which, being a much more ſubſtantial and more nouriſhing food, will certainly be very ſufficient. In this caſe, the ſmalleſt quantity computed on an acre (page 180 of this volume), *viz.* 19,000 pounds, will feed a fatting bullock 190 days: but if the computation of 28,506 pounds (as in page 181) is admitted, this will maintain a bullock 235 days; and as a bullock is generally fattened in three months, an acre of land will, with the firſt of theſe crops, fatten two bullocks, and with the ſecond, three. Mr. Miller, from information, declares, (p. 181), that an acre of carrots will go as far as three of turneps: from whence it follows, that my above allowance is probably more than any bullock can eat. This will appear ſtill more probable, if we judge

judge by the eſtimation which the people of Britany ſet upon their parſneps. It will likewiſe appear from hence, that theſe crops are at leaſt full as valuable as a crop of wheat; beſides the farther conſideration of their remaining but one ſeaſon in the ground. The reader will here obſerve, that I have over-rated the crop of wheat, and under-rated the value of the roots.

Experience has proved, and it will preſently be inſtanced again, that all roots, as well as pulſe and pot-herbs, grow better when planted in drills and horſe-hoed, than they do in broad caſt. Conſequently the new husbandry ſeems to be the moſt eligible, in proportion to their ſuperior value.

Another great recommendation of the new husbandry, is that clays and all binding ſoils are thereby brought into good order, much more effectually, and indeed ſooner, than they can poſſibly be in the old way, unleſs a fallow be continued for two ſucceſſive years, and managed at an extraordinary expence, eſpecially of very deep plowings. This appears evidently from ſeveral of M. de Chateauvieux's experiments, and particularly from that very remarkable one of the potter's clay, ſo often alluded to in the courſe of this work, and related at length in p. 259 of the firſt volume, to which the reader is referred.

As farther proofs in favour of the new husbandry, I ſhall here give another extract from the letter I have been favoured with from Lincolnſhire, and then add a few experiments made by M. de Chateauvieux, on plants which ſcarcely any other perſon would, perhaps, have thought of cultivating with the horſe-hoe, but which afford complete demonſtrations of the excellency of this method.

"Peas, ſays the former of theſe good authori-
"ties, ſucceeded prodigiouſly with me when ma-
"naged

" naged with the horſe-hoe. They not only grew " a great deal of ſtraw, but were alſo well corned: " The crops were full double to thoſe ſown in the " common way, on the adjoining land.

" I alſo ſowed beans on my land, contrary to " the advice all my farmers, who told me it was " too light for beans, and that, if they grew at " all, they would never corn. Notwithſtanding " this, I ventured to ſow them, and horſe-hoed " them carefully. They did not, indeed, grow " very high: but they had as many pods, and as " well filled, as thoſe in ſtrong clays.

" Turneps, I did not ſucceed ſo well with. In- " deed the difficulty of ſowing ſo ſmall a ſeed diſ- " couraged me: though, at my firſt trial, I got as " many good turneps without manure, as in the " next cloſe, with manure, but not ſo many of " them, and conſequently not ſo good a crop."

In 1753[e], M. de Chateauvieux planted a bed of colliflowers, in ground which had not been dunged for ſeveral years, but which was in fine tilth. They were tranſplanted on the 9th of June, cultivated with the horſe-hoe, and, on the 20th of Auguſt, he cut the two firſt heads *, which were very fine, and of an excellent taſte.

Cardoons, which he cultivated in the ſame manner, grew very fine, though they were greatly retarded by a ſhower of hail; and a row of aſparagus,

e DUHAMEL, *Culture des Terres, Tom.* III. *c.* 1. Art. 9.

* This was remarkably early for the country here ſpoken of (*viz.* the territory of Geneva): for it is very rare, either there, or even in France, that colliflowers are fit to cut before Michaelmas.

Mr. Miller is very right in obſerving, that the culture of this plant has been improved in England, much more than in any other part of Europe. Holland is generally ſupplied with it from hence: Germany knew not what a colliflower is, till within a few years paſt: and even now, moſt parts of Europe are ſupplied with it's ſeeds from England.

The

ragus which he planted in a bed ſix feet wide, and managed in the ſame way, made good ſhoots even in the firſt year [f].

" I have, ſays he, continuing this account of " his progreſs in new husbandry, likewiſe com- " municated to M. Duhamel [f], ſeveral beds ſix feet " wide, which I have planted with ſingle rows of " ſtrawberries. The vigour of the plants, the large- " neſs of their leaves, and the very great number " of their roots, give me room to expect that the " fruit will be very large and plentiful [g].

" The ſucceſs I have already had, the care with " which this culture is performed, the advantage " of not uſing dung, and that of being eaſed of " the trouble of watering, ſo neceſſary in kitchen " gardens, that, in hot weather, it takes up al- " moſt the whole of one man's time, are conſide- " rations of ſuch weight, that they determined " me to continue theſe experiments [h].

" In 1754, my ſtrawberries were admirable, " extremely large, finely ſcented, and of a very high " flavour. The aſparagus, which was in it's ſecond " year, was as fine as any in the beſt cultivated " gardens. Artichokes planted at the end of May, " produced in September their firſt fruit, which " was, in general, from twelve to fifteen inches in " circumference. Their leaves covered entirely " the beds ſix feet wide.

f *Ibid.* g *Ibid.*
h *Ibid. Tom.* IV. c. 3. *Art.* 11.

The colliflower was firſt brought to us from the iſland of Cyprus, where it is ſaid now to be in very high perfection; though is is ſuppoſed to have been originally carried thither from ſome other country. It was not brought to any degree of perfection, till about the year 1680: at leaſt it was not ſold in the markets here, before that time: but ſince the year 1700, our gardeners have improved it's culture ſo much, that colliflowers which were formerly thought very fine ones, would be little regarded now. *Gardener's Dict.* Art. BRASSICA.

" I have

" I have raiſed even melons in the ſame man-
" ner, without any dung, or hot-bed, and without
" bell-glaſſes, or any glaſs frame to cover them.
" I ſowed them as I would have done wheat. The
" plants came up perfectly well, and the fruit was
" ſo large and finely flavoured, that it might
" claim a preference in all reſpect to any that
" grew in my garden.

" I cultivated the ſame plants again in 1755,
" and 1756, in the ſame manner, and with the
" ſame ſucceſs, as before. They have always been
" larger, better taſted, and in every reſpect finer,
" than thoſe of my kitchen garden. Nothing could
" be more ſtriking, than" (as was obſerved before [g], ſpeaking of the pot-herbs which were a part of theſe experiments) " in 1755, a hot dry year, to
" ſee theſe plants, always green, and in great vi-
" gour, thrive without any alteration, while thoſe
" in gardens, which were watered every day,
" drooped during part of the day, and grew but
" very ſlowly.

" We may place the greater confidence in theſe
" experiments, as the ſame plants have been cul-
" tivated in the ſame manner for ſeveral years,
" and always with equal ſucceſs. Their beauty,
" largeneſs, and vigour, cannot be imputed to
" dung or other manure, for none was uſed: nor
" did they want watering, to which I never had
" recourſe, but when any of them were tranſplant-
" ed. It is therefore to the culture that their
" flouriſhing growth muſt be aſcribed; and this
" is the more remarkable, as it is well known,
" that, in the common management of kitchen
" gardens, if the ground was not to be dunged
" for ſeveral years, it would produce only poor and
" ſtinted plants."

M. de Chateauvieux extended the new husbandry even to the culture of the teazle, or fuller's

[g] *Page* 200.

thiſtel

thiſtle [h], which grew to a ſurprizing height, and produced an extraordinary number of the fineſt and beſt heads that the fullers in his country had ever ſeen.

This plant is of ſuch importance to the woollen manufactory, that, as I may, perhaps, not have occaſion to mention it again in this work, I muſt beg leave to add here Mr. Miller's directions for the culture of it, though foreign to my preſent ſubject.

"It is propagated by ſowing the ſeeds in "March, upon a dry ſoil. About one peck of "this ſeed will ſow an acre; for the plants "ſhould have room to grow; otherwiſe the heads "will not be ſo large, nor in ſo great quan-"tity. When the plants are come up, you muſt "hoe them in the ſame manner as is practiſed for "turneps, cutting down all the weeds, and ſing-"ling out the plants to about ſix or eight inches "diſtance; and as the plants advance, and the "weeds grow again you muſt hoe them a ſecond "time, cutting out the plants to a wider diſtance; "for they ſhould be, at laſt, left at leaſt a foot "aſunder: and you ſhould be particularly careful to "clear them from weeds, eſpecially the firſt ſum-"mer; for when the plants have ſpread ſo as to "cover the ſurface of the ground, the weeds will "not ſo readily grow between them. The ſecond "year after ſowing, the plants will ſhoot up heads, "which will be fit to cut about the beginning of "Auguſt; at which time they ſhould be cut and "tied up, in bunches, ſetting them in the ſun, if "the weather be fair; but if not, they muſt be "ſet in rooms, to dry. The common produce is "about an hundred and ſixty bundles, or ſtaves, "upon an acre, and they will ſell for about one "ſhilling a ſtave [i]."

h DUHAMEL, *Culture des Terres, Tom* IV. *c.* 3. *Art.* 12.
i *Gardener's Dict.* Art. DIPSACUS.

Though

Though the culture of perennial plants, ſuch as ſainfoin, lucerne, and burnet, does not ſtrictly belong to the new husbandry; yet, as it is probable that their growth is conſiderably benefited, on the principles of this method, by the ſtirring of the earth between the rows; I beg to charge to this account, the advantages ariſing from thence: advantages, which, if duly attended to, are of great national importance. To be ſatisfied of this, let us but reflect a moment on the profits accruing from lucerne, as proved by ſome of the foregoing experiments.

It appears from M. de Chateauvieux's experiments (p. 265), that an acre of lucerne will produce above ſix loads of dried hay; from M. Diancourt's (p. 271), that even ten loads and an half may be had from the ſame extent of ground; and M. Duhamel himſelf (p. 271) had ſeven loads. Now Mr. Miller ſays[k], he has been aſſured by perſons of undoubted credit, who have cultivated this plant in England, that three acres of it have fed ten cart horſes from the end of April to the beginning of October, without any other food, though they have been conſtantly worked.

The importance of the new husbandry will appear yet more conſiderable, if, viewing it in a national light, we attend to the extent of ground employed to feed a horſe in the uſual way. One horſe there conſumes the produce of three acres, in hay and corn: whereas the produce of one acre, for inſtance of lucerne, will certainly maintain one horſe all the year. Burnet promiſes to do the ſame. Conſequently the number of horſes in this kingdom may be tripled. If we make the ſame compariſon of the ground taken up by the plants before mentioned, *viz.* carrots, parſneps, turneps, &c.

[k] *Gardener's Dict.* Art. MEDICA.

with that which is now employed to raiſe graſs, hay, and corn, for the feeding and fattening of cattle; we ſhall find at leaſt the ſame proportion take place.

If again, we compute, in the ſame manner, the land now under corn in this kingdom, we might eſtimate one third to be fallow; but I will ſuppoſe it to be only one fourth: and if we reckon the crops, for inſtance of wheat, to be, in general, under three quarters to an acre; and that, from land kept conſtantly in ſo excellent order as it is in the new huſbandry, we might expect four quarters; the difference to the nation will become very great indeed: ſuch as, perhaps, no political arithmetician has yet dreamed of: — and the number of people may be proportionably increaſed.

Another circumſtance attending the general practice of the new husbandandry, in point of population, is, that as the land will yield a greater increaſe of it's various productions, and that increaſed variety will require a greater attention than is uſually beſtowed on farms, theſe muſt, in general become much leſs extenſive than they now are: and the certain conſequence of this will be, that the number of farmers and labourers being increaſed, the number of people in the country, the only ſource of population, will alſo be greatly augmented. If we look round this kingdom, and remark the numbers of acres lying waſte and uncultivated, and then add thereto the happy conſequences of an improved culture of the reſt; a very great, and a new, ſource of population immediately preſents itſelf. — This ſurely deſerves the moſt ſerious attention of the Legiſlature, and of every individual who is poſſeſſed of waſtes and commons.

CHAP.

CHAP. IV.

Of natural Grasses.

ALL the plants which require frequent culture in order to their being improved, for the food of cattle, having now been treated of; I proceed to the production of natural graſſes, commonly called Paſtures, which the writers on huſbandry rightly commend as the cheapeſt, eaſieſt, leaſt hazardous, and moſt profitable branch of farming.

It is ſurpriſing to think, how long a due attention to this important object has eſcaped the notice of mankind, and how much the eaſy means of making a proper advantage of the bounteous gifts of nature, in almoſt every country, have been ſtrangely neglected and overlooked: for, as the author of the *Swediſh Pan*[a] moſt judiciouſly remarks, though plants have been conſtantly obvious to the eyes of every man, nothing has been delivered down to us in any book, concerning the kinds of plants proper for the different kinds of cattle: the conſequence of which inattention frequently is, that the farmer, by not diſtinguiſhing and ſelecting the ſeeds of proper graſſes, fills his paſtures with weeds, or, which is here equivalent to them, with bad graſſes, unfit for the nouriſhment of the creatures which he intends to rear.

The illuſtrious Linnæus, in his journey through Dalecarlia, in the year 1734, made the firſt attempt to lay down rules for the farmer's guidance in this intereſting concern, as may be ſeen in the *Flora Lapponica* (p. 158), where he ſays: "In my

[a] N. Hasselgren. *Amænit. Academ. Suec. Tom.* II.

"journey through Dalecarlia, when we had climb-
"ed up the mountains, and were got into Nor-
"way, my fellow travellers being tired and aſleep,
"I wandered about in a thick wood, and ſoon
"perceived that the horſes eaſily diſtinguiſhed
"wholeſome from noxious food: for, being very
"hungry, they devoured all ſorts of plants, ex-
"cept the following, *viz.* meadow-ſweet, valerian,
"lilly of the valley, angelica, looſe-ſtrife, marſh-
"cinquefoil, crane's bill, hellebore, monk's hood,
"and ſeveral ſhrubs." This gave him a hint to recommend to the curious to ſet about examining what plants ſuch animals as live on vegetables will not touch.

The ingenious author of the fore-mentioned *Swediſh-Pan*, in order to encourage inquiries of of this kind, very properly obſerves, that we admire the wiſdom of the Creator, which has made ſome vegetables abſolutely diſagreeable to ſome animals, while they are agreeable to others; and plants which are poiſonous to ſome, but very wholeſome to others. This did not happen by chance, but was ordained for wiſe purpoſes. For if the author of nature had made all plants equally grateful to all kinds of quadrupeds, it muſt neceſſarily have happened, that one ſpecies of them having remarkably increaſed, another ſpecies muſt have periſhed by hunger, before it could have got into better paſture. In like manner we find it contrived in relation to the plants themſelves, which do not all grow in the ſame country and climate; but every plant has it's place, in which it grows more abundantly than elſewhere. From hence we may obſerve, that thoſe animals which chiefly live upon particular plants, abound moſt in certain places. Thus one animal leaves that which to itſelf is poiſonous, to another animal, which feeds upon it deliciouſly. Long-leaved water hem-

lock

pock will kill a cow, whereas the goat browſes upon it greedily. Monks-hood kills a goat, but will not hurt a horſe. Parſley is deadly to ſmall birds, while ſwine eat it ſafely; and pepper is mortal to ſwine, and wholeſome to poultry. Hunger will often drive animals to feed upon plants which nature never intended for them: but after this has happened once, they become more cautious for the future.

Without pretending to ſay whether the late fatal diſtemper among our horned cattle may have been owing to an unfortunate mixture of ſome noxious plant, or plants, among their food; to a vitiated quality of the water which they drank, or to an infection in the air; or whether either of theſe is, in any ſhape, the cauſe of that dreadful ſcourge which ſtill continues to afflict ſeveral of the northern parts of Europe, where whole herds are ſwept off almoſt inſtantaneouſly; the following paſſage in the great Linnæus's writing upon a ſimiliar ſubject, is an excellent example of the method of enquiring into the cauſes of the diſeaſes of cattle.

"When I arrived, ſays he, at Tornea*, the inhabitants complained of a terrible diſeaſe that raged among the horned cattle, which died by hundreds, ſoon after their being let into the paſtures in the ſpring. They deſired that I would conſider this affair, and give them my advice what was to be done, in order to put a ſtop to this evil. After a proper examination, I thought the following circumſtances worth obſerving.

"1. That the cattle died as ſoon as they left off their winter fodder, and returned to grazing.

* A city in Sweden, in the province of Bothnia; at the bottom of the Botner-ſea. It is alſo ſometimes called Torne Lapmark, from it's being ſituated near Lapland.

" 2. That the diſeaſe diminiſhed as the ſummer came on; at which time, as well as in the autumn, few died.

" 3. That this diſtemper was propagated irregularly, and not by contagion.

" 4. That, in the ſpring, the cows were driven into a meadow near the city, and that they chiefly died there.

" 5. That the ſymptoms varied much, yet agreed in this; that the cattle, upon grazing indiſcriminately on all ſorts of herbs, had their bellies ſwelled, were ſeized with convulſions, and in a few days expired with dreadful bellowings.

" 6. That no man dared to flea the recent carcaſes; as they found by experience, that not only the hands of ſuch as attempted it, but their faces too had been inflamed, and mortified, and that death had enſued.

" 7. The people enquired of me, whether there were any kinds of poiſonous ſpiders in that meadow; or whether the water, which had a yellowiſh tint, was not noxious.

" 8. That it was not a murrain was clear, becauſe the diſtemper was not contagious, and becauſe that diſtemper is not peculiar to the ſpring. I ſaw no ſpiders, but what are common all over Sweden; and as to the water, the ſediment at the bottom, which cauſed the yellowneſs, was nothing but what came from iron.

" 9. I was ſcarcely got out of the boat which carried me over the river into the meadow, before I gueſſed the real cauſe of the diſeaſe. For I there beheld the long leaved water hemlock. My reaſons for gueſſing this were as follow.

" 10. Becauſe in that meadow, where the cattle firſt fell ill, this poiſonous plant grows in great plenty, chiefly near the banks of the river. In other places it was ſcarce.

" 11. The

" 11. The leaſt attention will convince us, that brutes ſhun whatever is hurtful to them, and diſtinguiſh poiſonous plants from thoſe which are ſalutary, by natural inſtinct; ſo that this plant is not eaten by them in the ſummer and autumn; which is the reaſon that, in thoſe ſeaſons, and in the place I here ſpeak of, few cattle die, *viz.* only ſuch as either accidentally, or preſſed by extreme hunger, eat of it.

" 12. But when they are let into the paſtures in ſpring, partly from their greedineſs after freſh herbs, and partly from the emptineſs and hunger which they have undergone during the winter, they devour every green thing that comes in their way. It happens moreover that herbs at this time are ſmall, and ſcarcely ſupply food in ſufficient quantity. They are beſides more juicy, are covered with water, and ſmell leſs ſtrong; ſo that what is noxious is not then eaſily diſcerned from what is wholeſome. I obſerved likewiſe, that the radical leaves were always bitter, and the others not; which confirms what I have juſt ſaid.

" 13. I ſaw this plant in an adjoining meadow mowed along with graſs for winter fodder; and therefore it is not wonderful that ſome cattle, though but a few, ſhould die of it in winter.

" 14. After I left Tornea, I ſaw no more of this plant till I came to the vaſt meadows near Limmingen, where it appeared along the road; and when I got into the town, I heard the ſame complaints, as at Tornea, of the annual loſs of cattle, with the ſame circumſtances.

" 15. It would therefore be worth while to eradicate carefully theſe plants, which might eaſily be done, as they grow in marſhy grounds, and generally by the ſides of pools or rivers. But if this cannot be executed, the cattle ſhould not be ſuffered to go into ſuch places, at leaſt during the

ſpring: for I am perſuaded, that later in the year they can diſtinguiſh this plant by the ſmell alone *."

From experiments carefully and judiciouſly performed on the above extenſive, beneficial, and highly rational plan, we may know with certainty for what ſpecies of animals any paſture affords the beſt nouriſhment. We ſee, for example, heifers waſte away in encloſures where the meadow-ſweet grows in abundance, and covers the ground ſo that they can hardly make their way through it: while the country people, imagining that the paſture is too rich for them, are quite amazed, and do not dream that the meadow-ſweet affords them no nouriſhment: whereas the goat, which ſtands bleating on the other ſide of the hedge, is not ſuffered to go in, though he longs to be browſing upon this plant, which to him is a moſt delicate and nouriſhing food. Long experience has taught us, that ſheep take up poiſon in marſhy grounds, though no one, ſays M. Haſſelgrew, till lately knew what was the particular poiſon. Yet the ſpiderwort, the mouſe-ear ſcorpion graſs, the mercury, the ſun-dew, the hairy wood graſs, the leſſer ſpearwort, the butterwort, have evidently ſuſpicious marks. The *andromeda*, which the people of New-York call dwarf-laurel, is known to be a moſt rank poiſon to ſheep in Virginia, and very fatal to the ſame kind of creature in New-York. Of the ſame genus is the wild roſemary, a ſpecies of the *andromeda*, which infeſt, the paſture in the northern parts of Sweden; and equally deſtructive was the plant which the Marquis of Tur-

* In the ſpring, when water hemlock is under water, cows and oxen cannot ſmell it: but when the ſummer is come, and has dried the ground, they are very careful not to touch it.

billy

billy judiciouſly points out the means of extirpating in the paſtures of Anjou[c].

Mr. Stillingfleet obſerves[b] on the above remark in the Swediſh Pan, that there is great reaſon to think that what makes low grounds ſo noxious to ſheep is not the moiſture, but the plants which grow there: for it is noticed by ſhepherds, that the great danger to ſheep is immediately after a freſh ſpring of graſs, at which time he ſuſpects that they lick up the young and tender ſhoots of poiſonous plants, along with their proper food; not being able then to diſtinguiſh the one from the other.

From obſervations of this kind, continues the author of the *Swediſh Pan*, the huſbandman may form a right judgment of his meadows, and be very ſure that ſome are vaſtly preferable to others for certain animals: for although cattle, preſſed by neceſſity and hunger, will feed upon vegetables leſs grateful to them; yet it is not to be doubted but that they are not ſo well nouriſhed by theſe, as by others. "Thus the Dalecarlians are obliged, "in a ſcarcity of wheat, to ſupport themſelvs by "bread made of the bark of the pine: but it does "not, by any means, follow, that this affords pro-"per nouriſhment. Horſes, in time of war, when "urged by extreme hunger, will crop even dead "hedges: but we cannot thence conclude, that "wood is good food for them.

"The induſtrious farmer may judge from hence, "when he ſows his meadows, with hay ſeeds for "paſture, that it is not indifferent what kinds of "ſeeds he chooſes, as the vulgar inadvertently "think: for ſome are fit for horſes, others for "cows, &c. Horſes are nicer in chooſing than

[c] See Vol. I. *p.* 185.

[b] *Miſcellaneous Tracts p.* 355, note c.

"any

"any of our cattle. Plants whoſe ſeeds grow in "pods are particularly not reliſhed by them. "Goats feed upon a greater variety of plants than "any other cattle; but then they chiefly hunt "after the extremities and flowers. Sheep, on the "contrary, paſs by the flowers, and eat the leaves. "And again, different animals have different diſ-"poſitions as to grazing more or leſs near to the "ground *. The huſbandman who underſtands "theſe things, and who, in conſequence thereof, "knows how to lay out his lands, ſo as to aſſign "to each kind of cattle it's moſt proper food, "muſt neceſſarily have his flocks and herds "healthier and fatter, than he who is unacquaint-"ed with theſe principles. The good manager will "obſerve the ſame precautions in the making of "his hay: for although many herbs are eaten "when dry, which would be refuſed while green, it "does not from thence follow that they yield good "nouriſhment. Much might be added concern-"ing the propenſity of cattle to this or that plant: "for example, that ſheep delight, above all "things, in the feſcue-graſs *(feſtuca)*, and grow "fatter upon it, than on any other kind of graſs;

* Animals with inciſory teeth in both jaws, as the horſe and aſs, nip more eaſily ſhort herbage, than thoſe whoſe upper jaw is without the inciſory; and if the ſheep and goat cut the herbage very cloſe, it is owing to the ſmallneſs and thinneſs of their lips; but the thick lipped ox can only crop the long herbage; and this is the true reaſon why he never injures the paſtures in which he lives. As he crops only the extremity of the young herbage, he does not affect the root, and retards it's growth but very little; whereas the ſheep and goat, by nipping the herbage very cloſe, both deſtroy the ſtem and injure the root. The horſe chooſes the moſt ſlender herbage, while the larger, whoſe ſtems are hard, he leaves to feed and multiply: whereas the ox crops thoſe thick ſtems, and by degrees deſtroys the coarſer herbage. Hence it is, that after ſome years the herbage where a horſe has lived becomes coarſe; whereas that where the ox has fed becomes a fine paſture. DE BUFFON, *Natural Hiſtory of the Horſe, &c.*

"that

" that goats prefer certain plants, but, being led " by an inſtinct peculiar to themſelves, they ſearch " more after variety, and do not willingly ſtick " long to any one kind of food; that geeſe are par- " ticularly fond of the ſeeds of the feſcue-graſs; " that ſwine hunt greedily after the roots of the " bull-ruſh, while they are freſh, but will not touch " them when dry. It is an error to think, as many " of our (the Swediſh) peaſants do, that hogs, " when they turn up the ground in queſt of ſcor- " zonera roots, or of clowns-all-heal, or wound- " wort, eat the roots of couch graſs; for they never " touch theſe, but when preſſed by the utmoſt " neceſſity."

In like manner, adds Mr. Stillingfleet, in a note upon the above paſſage, a notion prevails among us, that cows eat the crows-foot which abounds in many meadows, and that this renders their butter yellow; from whence this plant derives it's common name of the butter flower. But he believes that this is a miſtake, becauſe he never could perceive that any part of the crow-foot was touched by cows or any other cattle*. Linnæus too obſerves[b], that ſome people imagine that the marſh-marigold makes butter yellow; though, in reality, cows never touch that plant. He thinks, however, that all kinds of paſture will not give that yellowneſs, and then remarks, that the beſt and yelloweſt butter

* This agrees with Mr. Liſle's obſervation [a], that ſeveral ſpecies of the meadow ranunculus, or crow-foot, are common in our meadows; that they bliſter and ulcerate the fleſh while they are green, and that cattle, will not touch them in that ſtate: but that they will feed on them greedily, after they have been dried and made into hay. — Dr. (afterwards Sir Hans) Sloan mentions this, to account for the caſſivis root, which, though a ſtrong poiſon when green, makes wholeſome bread after it has been baked.

[a] *Obſervations in Husbandry*, Vol. II. Art. GRASSES, §. 63.
[b] *Flor. Lappon*, p. 195.

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he ever ſaw, and which is preferred to all other ſorts by the dealers in the places where it is made, proceeds from the milk of cows fed where the cow-wheat grows in greater plenty than he ever knew elſewhere. A proof how very incurious the country people are in relation to things they are every day converſant with, and which it concerns them ſo much to know.

M. Haſſelgren continues thus. "The animals "ought not to be over hungry, when we make "our experiments, if we intend to make them "properly: for, at ſuch a time, they will greedily "devour moſt kinds of plants, which they would "abſolutely refuſe at another. Thus, when they "come immediately out of the houſe, they are "not fit to make experiments upon; becauſe they "are then ravenous after every green thing that "comes in their way. Beſides, ſome plants are "eaten by them in the ſpring, which they will not "touch all the ſummer, when they are apt to "grow rank in taſte and ſmell, and become ſtalky "and hard. The beſt method is, to make the "experiment when their bellies are almoſt full; "for they are hardly ever ſo entirely: and another "caution to be obſerved, is that the plants be not "handled by ſweaty hands; becauſe ſome animals "will, in that caſe, refuſe even the moſt palatable. "They ſhould be thrown upon the ground, and "if the animal refuſes to eat them, let them be "mixed with other ſorts which are known to be "liked. If they are ſtill refuſed, the proof is ſure; "eſpecially if it be tried with ſeveral individuals "of the ſame ſpecies."

A gentleman who has at heart the improvement of his own fortune, as well as the good of the public, ſhould not only make experiments as to the plants which are eaten moſt greedily by different cattle, but he ſhould alſo have what I would call

call a field of experiments. He ſhould have ſeeds of every kind of plant which he ſees thrive, and which has not yet been ſown alone, gathered free from any mixture, and he ſhould ſow theſe in that field, in order there to view it's growth, to try the moſt proper way of cultivating it, and to be able to extend his obſervations, on it's uſe to various creatures. The uſefulneſs of ſuch a ſpot appears by the important addition which Mr. Rocque has made to our artificial paſtures, by introducing burnet into them, which he was enabled to do, only by it's being planted by itſelf.

I may certainly, with Mr. Worlidge[b], aſſure the farmer, that "there are many moſt rare and excellent plants, which, if they were advanced or propagated ſo as openly to manifeſt their worth, might be of much more advantage to the laborous husbandman, than the ſhort, ſour, and naturally wild and barren graſs, mixed with a ſuper-abundant proportion of pernicious weeds. Therefore it would be very acceptable ſervice to the whole nation, if thoſe who have land enough, would yearly prove ſome ſmall proportion of theſe and other vegetables, not yet brought into common uſe: by which means they would not only advance their own eſtates, but the whole nation in general, and gain to themſelves an everlaſting fame and honour, as did the families of Piſo, Fabius, Lentulus, and Cicero, by bringing into uſe the ſeveral pulſes from which they derived their names."

Mr. Miller, ſenſible of the advantages of this method, tried to ſave the ſeeds of various kinds of graſſes, unmixed, in order to determine their qualities; but not having ground enough to propagate them ſeparately in any quantity, he was obliged to abandon this purſuit: but he ſtrongly

[b] *Syſtema Agriculturæ*, p. 32.

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recommends to perſons who have ſufficient ſkill and leiſure, with land to ſpare for experiments of this kind, to carry into execution this plan, which, as he juſtly obſerves[c], may be of ſingular ſervice to the public.

Paſtures are naturally divided into meadows and upland. It is very ſeldom that we meet with the one or the other in ſo good condition, but that they are either over-run with moſs and weeds, or the ſoil itſelf is in ſo bad a ſtate, as to require being mended before any improvement can be made.

There is no part of husbandry, with which farmers in general are leſs well acquainted, than with that which relates to paſtures. I ſhall therefore be as particular as poſſible in my directions here. To this end, I ſhall begin with the means of improving the ſoils for meadows and upland paſtures; then give the names and culture of the different graſſes recommended by authors; and laſtly, the improvement of paſtures already laid down to graſs.

SECT. I.

Of the improvement of Soils for Paſtures.

MEADOWS, lying low, and generally level, are ſubject to be wet, or overflowed, eſpecially in the winter: but it would be needleſs to repeat here any part of the ample inſtructions before given for draining land*; nor will it be neceſſary again to treat of the differences of ſoils, any farther then may be requiſite in order to give ſome particular directions to fit them for the purpoſes of paſture.

c *Gardener's Dict.* Art. GRAMEN.

* See Vol. I. *p.* 132. and 176.

Meadow

Meadows, being generally enriched with the fine mould waſhed down from the adjacent riſing grounds, are uſually of a good ſoil, and ſeldom require any other improvement, than the removing of temporary imperfections. But they may likewiſe be of ſuch a nature as to ſtand in need of a more particular treatment: as is the caſe when their ſurface is a moſſy looſe earth, or when it is of a binding or clayey quality.

If, through long neglect, a coarſe ſtrong graſs, ruſhes, or other buſhy plants, be ſuffered to remain upon the ground till they rot there, they will, in ſome years, form a looſe ſpongy ſubſtance, ſomewhat reſembling the moſs deſcribed in my firſt volume †. In this caſe, the firſt neceſſary ſtep is to pare off and burn that looſe ſurface, or at leaſt ſo much of it as to enable the plough afterwards to reach the better ſoil underneath. The manner of doing this has already been explained ſo very amply ‡, that it will be ſufficient to add here, that this looſe upper earth muſt be ſo ſtrengthened as to afford ſufficient ſtability to the roots of whatever plants are ſown on it, by mixing it well, either with the better ſoil underneath, or with marle, clay, or rich loam, brought to it from the neighbouring grounds, or with the compoſts before directed for this purpoſe ‖.

If the ſoil is clay, or a ſtrong binding earth, the treatment of it is much the ſame, whether it be meadow or upland paſture. Such ſoils, by retaining water in every hollow place, become what the farmers call ſour, and produce a coarſe graſs, compoſed, as Mr. Miller obſerves [h], of bad weeds, of which the ſeveral ſorts of docks make no ſmall ſhare. Although many of the meadows produce

† Page 125.
‡ See Vol. I. *c.* 1. §. 4. art. 3. and *c.* II. §. 2. and 3.
‖ Vol. I. *p.* 157. & *ſeqq.*
h *Gardener's Dict.* Art. MEADOW.

a great

a great burden of what the country people call hay, yet this is fit only for ſuch cattle as, by hard labour and hunger, are driven to eat it: for horſes which have been accuſtomed to feed on good hay, will almoſt ſtarve rather than touch this. A plain proof of it's being diſagreeable to all cattle, is, that when they are turned in, after it has been mowed, we often ſee the ground covered with rank weeds, which they will not meddle with.

When a paſture is in the ſtate above deſcribed, if there is a ſufficient depth of ſoil to admit of it, the ſurface ſhould be pared off, and burnt: and as ſuch places are uſually over-run with ant-hills, theſe ſhould alſo be burnt; after which, by the addition of proper manure, as directed for the improvement of ſtrong ſoils *, and by the help of deep plowing, the land ſhould be brought into fine tilth. The deeper this improvement goes, the deeper and more laſting will the graſs be. I have been informed of a particular inſtance of the good effects of this method, by which the gentleman who practiſed it had graſs which continued for years in a ſtrong ſtate of vegetation, and was conſtantly near a month forwarder than that of his neighbours, whoſe ſoil and ſituation were exactly the ſame.

Let not any one be deterred by the expence attending this improvement: for the crops of grain and other plants taken while the ſoil is thus preparing, will nearly repay all the charges, and the ground will afterwards yield much more plentiful crops of graſs; at leaſt for a number of years. But as clayey lands require more frequent and more thorough repairs than other ſoils, the returns of tillage propoſed by Camillo Tarello will be the moſt proper means of managing them.

* *Vol.* I. *p.* 19. and 110.

He

He[d] would have farmers divide their paſtures into four parts, keep one of theſe parts under grain or pulſe, during five years, and at the expiration of that time lay it down to graſs as before; and ſo proceed with every other part. He propoſes, that the firſt breaking up ſhould be by paring and burning, and thorough plowing. But if I may differ from him in opinion, I think 'tis needleſs to keep the ground ſo many years in tillage, unleſs this ſhould ſuit the husbandman's convenience for the culture of particular plants. In this caſe, the paſture may be divided into five or ſix parts. After each part has thus been in tillage, Tarello adviſes breaking up again the ſpot firſt began with; though not by burning now, but only by plowing, in order to ſow it as before. "This, "ſays, he, will be profitable to the husbandman, "and improve the paſture. It will benefit the hus- "bandman, becauſe he will thereby raiſe a greater "quantity of corn; and it will do good to the "paſtures, becauſe nothing is more ſerviceable to "them, than this renewal of their ſurface, as is "atteſted by Columella[e]. Let not the husband- "man imagine that he will have leſs hay when "only three fourths of his uſual extent of land are "under graſs: for, in fact, it is not the quantity "of the land, but the care which is taken of it, "that gives plenty of hay."

When a ſoil of this kind is laid down for meadow, great care ſhould be taken to ſlope it down gently, from the middle, in ſuch manner that no water may reſt on any part of it. If the extent is large, ſmall ditches ſhould interſect the meadow into as many diviſions as ſhall be neceſſary to form a ſufficient drain for the waſte water, and the ſpaces

[d] *Ricordo d'Agricalturo, p.* 7.
[e] *De Re ruſtica, Lib.* II. *c.* 18.

between theſe ditches may be gently raiſed. In an upland paſture on ſuch a ſoil, ridges ſhould be raiſed inclining a little from the horizontal, that the furrows may be ſo many drains, as before directed † in the plowing of ſuch ſoils, to prevent their becoming ſpewy or wet: for as the rain cannot deſcend beyond the clay, it will glide along it, till, collected in ſuch quantities as to form a ſmall ſtream, it iſſues forth at the ſurface, uſually loaded with ſome mineral quality imbibed from the earth underneath.

When the ſoil is a rich or light loam, the plough will not be ſo neceſſary; as ſuch meadows or paſtures may be repaired by the means which will be pointed out in the directions hereafter given for thim provement of meadows already laid down to graſs.

SECT. II.

Of the names and cultures of the ſeveral Graſſes fitteſt for Paſtures.

I Muſt here obſerve once more, with Mr. Stillingfleet [f], that it is wonderful to ſee how long mankind has neglected to make a proper advantage of plants of ſuch importance as graſſes are, and which are the chief food of cattle in almoſt every country. The husbandman, for want of diſtinguiſhing and ſelecting graſſes for ſeed, fills his paſtures either with weeds, or with bad, or improper, graſſes; when, by making a right choice, after ſome trials, he might be ſure of having the beſt graſs, and in the greateſt abundance that his land admits of. In the common way of pro-

† *Vol.* I. *p.* 283.

f *Obſervations on Graſſes, in his Collection of Miſcellaneous Tracts, p.* 365.

ceeding

ceeding, if a farmer wants to lay down his land to graſs, he either takes his ſeeds indiſcriminately from his own foul hay-rick, or ſends to his neighbour for a ſupply. By this means, beſides a certain mixture of rubbiſh, which muſt neceſſarily happen; it is not unlikely, but that what he intends for dry land may have come from moiſt, where it grew naturally, and ſo on the contrary: and the conſequence of this ſlovenly method frequently is, that the ground, inſtead of being covered in one year with a good ſward, is filled with weeds not natural to it, which would never have ſprung up, if they had not been brought thither.

"Arguments, ſays my abovementioned author, "are never wanting in ſupport of ancient cuſtoms, "and I am no ſtranger to thoſe, ſuch as they are, "which prejudice and indolence have made uſe "of on this occaſion.

"1. Some ſay then, that if you manure your "ground properly, good graſſes will come of "themſelves. I own they will. But the queſtion "is, how long it will be before that happens: and "why be at the expence of ſowing what you muſt "afterwards try to kill? which muſt be the caſe, "as long as people ſow all kinds of rubbiſh under "the name of hay ſeeds. Again, if the beſt way "is to let the ground take it's chance, why is the "farmer at the expence of procuring the ſeeds of "the white, and broad clover, which come up in "almoſt all parts of England ſpontaneouſly? But "if this is allowed not to be the beſt way in rela-"tion to clover of any kind, what reaſon can be "in nature, why graſs ſeeds only ought not be "ſown pure?

"2. Others ſay, that is better to have a mixture "of different ſeeds. I will ſuppoſe this to be "true. But cannot a mixture be had though the "ſeeds be gathered, and ſeparated? and is not a

" mixture by choice more likely to be proper,
" than one by chance? eſpecially after a ſufficient
" experience has been had of the particular vir-
" tues of each ſort, of the different kinds of cattle
" which each graſs is moſt adapted to, of the
" different grounds where they will thrive beſt,
" &c. all which circumſtances are now, in gene-
" ral, wholly unknown, though of the utmoſt con-
" ſequence.

" 3. It is ſaid by ſome, that weeds will come
" up along with the graſs. No doubt of it. Can
" any one imagine that graſs ſeeds ſhould be ex-
" empted from what happens to every other kind
" of ſeeds? But I will venture to ſay, that not
" near the quantity of weeds will ſpring up which
" they imagine, if the graſs be ſown very thick.
" Men muſt be very much put to it, when they
" make ſuch objections as this laſt, or indeed any
" of the others. I am almoſt inclined to ſay with
" a great writer, " It is a ſimple thing to take
" much pains to anſwer ſimple objections."

" One would hardly think it poſſible that the
" ſlovenly method of proceeding here complained
" of could prevail univerſally: yet this is the caſe
" as to all graſſes, except the darnel (or rye) graſs,
" and what is known in ſome few countries by the
" name of the Suffolk graſs; and this latter in-
" ſtance is owing, I believe, more to the ſoil, than
" to any care of the huſbandman. Now would
" the farmer be at the pains of ſeparating, once
" in his life, half a pint, or a pint, of the different
" kinds of graſs ſeeds, and take care to ſow them
" ſeparately; in a very little time he would have
" wherewithal to ſtock his farm properly, accord-
" ing to the nature of each ſoil, and might at the
" ſame time ſpread theſe ſeeds properly over the
" nation, by ſupplying the ſeed-ſhops.

" I have

"I have had frequent experience how eaſy it is "to gather rhe ſeeds of graſſes, having ſeveral "times employed children of ten or eleven years "old, who have gathered many ſorts for me with- "out making any miſtakes, after I had once ſhewn "them the ſorts I wanted.

"I have procured thus the creeping bent, the "fine bent, the ſheep's feſcue, the creſted dog- "tail, &c. in ſufficient quantities to begin a ſtock; "but, for want of a proper opportunity of culti- "vating them myſelf, or meeting with any one "who had zeal enough to beſtow a proper care on "them, my collections of this kind hitherto have "only proved, that the ſcheme is in itſelf feaſible.

"In the year 1761, a little boy gathered, by "my directions, as much of the creſted dog-tail, "in three hours, by the ſide of a road, as, when "ſhed, yielded upon weighing above a quarter of "a pound averdupois, perfectly free from huſks. "As this ſeed is ſmall, the ſkilful will eaſily judge "how far ſuch a quantity would go if properly "employed.

"My very eſtimable and ingenious friend, Mr. "Aldworth, who was witneſs of the fact which "I laſt mentioned, at my deſire ordered a ſmall "part of a meadow, near his ſeat at Stanlake, "which had better graſſes, and leſs mixed, than "the reſt, to be left unmowed till the ſeeds were "fit for gathering. This piece yielded, upon "threſhing and ſifting, a full buſhel by meaſure "of almoſt pure ſeed of the creſted dog-tail.

"In caſe any one ſhould be inclined to follow "this example, I think it highly neceſſary to ob- "ſerve, that care muſt be taken to mow the graſs "before it ſheds; that it be mowed very early "in the morning, before the dew is off the "ground, and that it ought not to be ſpread, as "in making hay, but left as it falls from the

" ſcythe during a ſufficient time, and then be " gently turned over.

" The number of graſſes fit for the farmer is, " I believe, very ſmall: perhaps half a dozen, or " half a ſcore, are all he need to cultivate; and " how ſmall the trouble would be of collecting the " ſeeds of theſe, and how great the benefit, muſt " be obvious to every one at firſt ſight. — Would " not any one be looked upon as wild, who ſhould " ſow wheat, barley, oats, rye, peas, beans, vet- " ches, buck-wheat, turneps, and weeds of all " ſorts, together? Yet how is it much leſs abſurd " to do what is equivalent in relation to graſſes? " does it not import the farmer to have good hay " and graſs in plenty? and will cattle thrive equal- " ly on all ſorts of food? We know the contrary. " Horſes will ſcarcely eat hay that will do well " enough for oxen and cows. Sheep are particu- " larly fond of one ſort of graſs, and fatten upon " it faſter, than on any other, in Sweden, if we " believe Linnæus. And may they not do the " ſame in England? How ſhall we know, till we " have tried? Nor can we ſay, that what is va- " luable in Sweden, may be inferior to many " other graſſes in England; ſince it appears, by " the Flora Suecica, that they have all the good " ones that we have. But however this may be, " I ſhould rather chooſe to make experiments, " than conjectures."

The illuſtrious Society for promoting Agriculture, &c. in the province of Britany, has laid down the moſt rational plan[g] yet formed by any body of men, nobly aſſociated for the welfare of their country; and which promiſes the greateſt advantages to mankind. A part of this plan is, the

[g] *Corps d'Obſervations de la Societé d'Agriculture, de Commerce, et des Arts, établie par les Etats de Bretagne.* Art. AGRICULTURE.

cul-

cultivating ſeparately moſt of the plants which grow naturally in the fields there, in order to know which of them will afford the moſt, and the beſt, food for cattle.

As the husbandman would not be benefited by knowing the particular claſſes, genera, &c. under which Ray, Linnæus, and other botaniſts have ranged the ſeveral ſpecies of graſſes; I ſhall here content myſelf with giving the names of ſuch of them as may be cultivated to moſt advantage in this country, with the beſt drawings (for which we are indebted to Mr. Stillingfleet) of ſome of the moſt profitable ſorts, which it will be of ſervice to the farmer to be able to diſtinguiſh rightly.

The *common Dogs graſs*, *Quich graſs*, or *Couch graſs* (*Gramen ſpicâ triticeâ repens vulgare, caninum dictum* [h]) common creeping graſs with a ſpike like wheat, called Dogs graſs[i], will thrive in almoſt any ſoil, and can ſcarcely be got out again after it has once taken poſſeſſion: ſo greatly does it multiply by it's roots and trailing branches, which put forth roots and ſhoots at every joint. It grows to the height of four or five feet, with blades ſo rough and coarſe, that few horſes will eat them, eſpecially while they are green: but it yields abundant crops of hay, which does well enough for oxen, and therefore deſerves, perhaps, more attention than our farmers have yet beſtowed upon it. M. Duhamel indicates the beſt way of making the moſt of it, when he directs [k] the farmer always to mow it before it's ſeeds ripen, or it's ſtalks grow hard; for after that, cattle refuſe it: adding, that it ſoon ſhoots up again, and will bear frequent cutting.

h RAII, *Synopſis Stirpium Britannicarum. p.* 390. *Edit.* 3.
i MILLER's *Gardener's Dict.* Art. GRAMEN.
k *Eléments d'Agriculture, Tom.* II. *Liv.* 9. *c.* 2. *art.* 2.

This plant is well known to all husbandmen, to whom it is a ſad plague when it gets into their arable land. It is the *chiendent* of the French; who, I muſt obſerve here for the benefit of their husbandry, do not diſtinguiſh it ſufficiently from our

Rye graſs, which is C. Bauhin's *Gramen loliaceum, anguſtiore folio, et ſpicæ*, Darnel graſs with a narrower leaf and ſpike; and Linnæus's *Lolium ſpicâ muticâ*, Darnel with a chaffy ſpike: for darnel graſs, rye graſs, and ray graſs, are only different names of one and the ſame plant: though M. Duhamel, miſled by the erroneous ſpelling of ſome writers, who have called rye graſs, ray graſs, has been miſtakenly induced to think that theſe are two different plants with us[l]. We diſtinguiſh, indeed, two conſiderably different ſpecies of the rye graſs, *viz.* the foregoing, which according to Mr. Ray, is the *Lolium rubrum*, or *red darnel*; and the *Lolium album*, which, according to the ſame author, is C. Bauhin's *Gramen loliaceum ſpicâ longiore*, Darnel graſs with a longer ſpike, and the *Yvraie* of the French, by us commonly called *darnel* only. But both of them are equally rye graſs. It is the laſt of theſe ſpecies, *viz.* the *Lolium album*[m], which is chiefly cultivated in England, eſpecially in ſtrong cold land, upon which it will ſucceed better than any other ſpecies, and is an earlier feed in the ſpring[n]: but it is very coarſe, and unleſs it be cut quite early for hay, it becomes ſo hard and wirey in the ſtalks, that few cattle care to eat it: for this ſort of graſs has but few leaves, and runs all to ſtalks. When cattle have been turned in to feed upon it, the remaining ſtalks, or *bents*, as they

l *Ubi ſupra.*

m RAII, *Hiſt. Plant. p.* 1262, *& Synops, p.* 395.

n Miller's *Gardener's Dict.* Art. GRAMEN.

are

are ſometimes called, ſhould be mowed off in June; for otherwiſe they will dry upon the ground, give the paſture the diſagreeable appearance of a ſtubble field during all the latter part of ſummer, and be ſo very troubleſome to the cattle which feed on it, by tickling their noſtrils, that nothing but the want of better grazing will compel them to eat of the young graſs which ſhoots up between theſe withered ſtems; for they will not eat them. Thoſe who think that they do, when ſtreightened for food, are greatly miſtaken, according to Mr. Miller, who ſays, that he has cloſely attended to this many years, and has always found theſe bents remaining on the ground untouched, till the froſts, rain, and winds, have deſtroyed them in the winter. Beſides this, by permitting them to ſtand, the after growth of the graſs is greatly retarded, and the beautiful verdure of the fields is loſt for three or four months. It therefore is good husbandry to mow them cloſe to the ground, before they become too dry: and if this cutting is then made into hay, it will ſerve to feed cart horſes in the winter, ſo as to repay the expence of mowing.

The red darnel is a conſiderably inferior ſpecies of rye graſs: for it has yet narrower leaves, and it's ſtalks grow hard much ſooner. It is very common in moſt paſture grounds; becauſe it flowers early, and it's ſeeds ripen and ſow themſelves before the hay is cut. They, therefore, who would keep their paſtures as clear as poſſible from this graſs, ſhould always mow them before it's ſeeds are ripe.

Rye graſs is uſually ſown with clover, upon ſuch lands as are deſigned to be plowed again in a few years; and a common method is to ſow it with ſpring corn. But Mr. Miller, from many repeated trials, has always found, that when this graſs has been

been ſown in Auguſt, and a few ſhowers have fallen ſhortly after, the crop has been by much the beſt: for it then has often been ſo high as to afford a good feed the ſame autumn; and a ton and a half of hay has been mowed early the next ſpring off each acre of land, though it has been a cold and ſour ſoil. "I am therefore, ſays he, con-
"vinced of that being the beſt ſeaſon for ſowing
"theſe graſſes; though it will be very difficult to
"perſuade theſe perſons to alter their practice,
"who have been long wedded to old cuſtoms.
"The quantity of ſeeds which I allow to an acre
"is about two buſhels, and eight pounds of
"the common clover, which, together, will make
"as good a covering upon the ground as can be
"deſired. But this is not to be practiſed upon
"lands where the beauty of the verdure is prin-
"cipally regarded. It is fitteſt for thoſe who have
"only profit in view." — However, we muſt reckon as an abatement of this profit, that, as M. Duhamel rightly obſerves, the ground that has been under rye graſs, which is not ſo profitable a crop as either lucerne, ſainfoin, or even clover, is not able to bear wheat the next year; as it is after thoſe other plants, or after a crop of roots.

According to Mr. Liſle's information °, the farmers in the iſle of Wight prefer rye graſs to hop clover, becauſe, ſay they, the rye graſs will bear the winter, and keep to a good head, which the clover will not do. One of his tenants there had an acre and a half of rye graſs upon tolerably good ground, which he ſhut up from Michaelmas till within a month of Candlemas, and from thence to the middle of April it kept fifteen ewes and fifteen lambs.

° *Obſervations in Huſbandry*, Vol. II. *p.* 57. art. GRASSES, §. 48.

Rye

Rye graſs ſeldom laſts more than three years, as it is commonly managed: but Mr. Liſle is ſtrongly of opinion, that, conſidering the nature of it's roots, and it's manner of propagating itſelf by ſending forth fibres from it's joints, it may be kept alive many years longer, by dunging it, or by refreſhing it with ſoil, when it begins to decay, after the ſecond or third year: beſides which, this will make it's roots tiller, and mat on the ground, to the utter ſuppreſſion and deſtruction of all weeds, not excepting even the couch graſs.

An acquaintance of his near Upcern, in Dorſetſhire, told him, that he had as much rye graſs ſeed on eighteen acres of land, as was worth twenty pounds; and that, after the ſeed was threſhed out, that hay was better than oat-ſtraw fodder. — Mr. Liſle himſelf ſaw a rick of this coarſe ſtubbed hay, and a rick of oat ſtraw, both of which had been laid open to the cattle, in the ſame place; and they would not touch the ſtraw, but had made ſuch a hole in the rye graſs hay rick, that it was ready to fall. The ſame perſon aſſured Mr. Liſle, that he found the rye graſs to be excellent food for his cattle, if it was mowed green, and not kept for the lucre of the ſeed. His uſual allowance was three buſhels of this ſeed to an acre of land, and he uſed to ſell it for twenty two pence, or two ſhillings, a buſhel.

Another farmer ſhewed Mr. Liſle ſome of his rye graſs, ſaying, that he looked upon it as his choiceſt fodder for ſheep. He mowed it when in the flower; and Mr. Liſle declares, that he thought it very fine hay. — Others again, and thoſe men of experience, have affirmed, that the very ſtubble of the rye graſs, mowed the ſame year it was ſowed, is, when plowed in, as good as dunging, and will pay for the ſeed.

Mr.

Mr. Liſle agrees with all other experienced huſbandmen, that, though rye graſs will maintain as many cattle on an acre, as hop clover will do; yet it does not, like it, improve the land for a ſubſequent crop of corn: the reaſon of which he takes to be, that the roots of the rye graſs, conſiſting of a multitude of matty fibres, which run on the ſurface of the ground, gird and hold the earth ſo ſtrongly together, that they cannot eaſily be diſentangled from it by plowing.

"If I may judge of this graſs, ſays Mr. Stilling-
"fleet [P], by the veniſon I have eaten out of a pad-
"dock that was chiefly filled with this ſpecies, I
"would by no means recommend it for parks. I
"know it will be ſaid, that veniſon is never good
"out of paddock, that the deer muſt have room
"to range, trees to browſe on, &c. I grant there
"is ſome reaſon for ſaying this, but I believe in
"general it is more owing to the want of proper
"food, *viz.* good graſs, than merely to confine-
"ment: for paddocks are generally made out of
"a rich ſpot of ground near the houſe, that has
"conſtantly been manured, and of courſe is full
"of graſs fitter for the dairy or the ſtable, than
"for deer; which hardly ever is the caſe in large
"parks. No man will, I ſuppoſe, pretend to make
"good pork from a hog fed with grains inſtead
"of peas, though he has the liberty of chooſing
"as much ground as he pleaſes, and where he
"pleaſes."

In a ſubſequent edition of his Obſervations on Graſſes, he adds: "I have ſince eaten veniſon out
"of a large park, where there was much of this
"graſs, and it was no better than that out of the
"paddock. I ſhould be apt to think from hence,
"that this graſs would not be proper for ſheep,

[P] Page 388.

"as

" as I have always obſerved that the ſame kind of " ground which yields good venſion, yields alſo " good mutton. For what particular uſes it is " good, wants to be tried; whether for the dairy, " for fattening cattle, or for horſes. Many are " tempted, by the facility of procuring the ſeed " of this graſs, to lay down with it grounds near " their houſes, where they want to have a fine " turf: but, unleſs the ſoil be very rich, a worſe " graſs cannot be choſen for this purpoſe, as it will " certainly die off entirely in a very few years."

The *Wall barley*, or *way bennet*, as ſome people improperly term it, is evidently, from the ſhape of it's ear, and from every other characteriſing circumſtance, a *rye graſs*, or *wild rye*, as Mr. Ray obſerves [q]; though very different from the preceding. It is the *Gramen ſecalinum et ſecale ſylveſtre* [r], called *tall meadow rye graſs* by Mr. Miller [s], who reckons it an excellent graſs for ſowing, becauſe it is very leafy, it's ſtalks do not become ſtiff and hard like many other ſpecies, and it's roots are perennial. He ſeems not to doubt but that it may be rendered very fine by proper care; and as it's roots are perennial, rolling will make them mat, ſo as to form a very cloſe ſward. There are three ſorts of it, *viz.* the greater, the leſſer, and the marſh rye graſs. Mr. Stillingfleet wiſhes that this genus only were to be called *rye graſs*, and that the old name of *darnel* were continued to the *Gramen loliaceum*, or *rye graſs*, before ſpoken of.

The two beſt ſpecies of graſs for paſtures are, in Mr. Miller's, opinion [t], C. Bauhin's *Gramen pratenſe, paniculatum majus, anguſtiore folio*, meadow graſs, with large panicles, and a narrower leaf, which is the *Poa paniculâ diffuſâ, ſpiculis qua-*

[q] *Hiſt. Plant. p.* 1258, and *Synops. p.* 391.
[r] JOHNSON, *ap Gerardum.*
[s] *Gardener's Dict.* Art. GRAMEN. [t] *Ibid.*

driſloribus

drifloribus pubeſcentibus culmo erecto teretri, Flor. Suec. 77. *Poa* with a diffuſed panicle, the ſmaller ſpikes having four hairy flowers, and a taper erect ſtraw; and C. Bauhin's *Gramen pratenſe, paniculatum majus, latiore folio*, Meadow graſs, with a larger panicle, and broader leaf, which is the *Poa paniculâ diffuſâ, ſpiculis trifloribus glabris, culmo erecto teretri*, Flor. Suec. 76. *Poa* with a diffuſed panicle, ſmall ſpikes with three flowers, and an upright ſtraw.

I take theſe to be the *Great Meadow Graſſes* repreſented in *Plate III, Fig.* 1, for which I am indebted to Mr. Stillingfleet, and which as he obſerves, are common in our beſt meadow grounds. He has alſo met with them frequently on banks by the road ſide, and near ditches, even where they were not to be found in the adjoining meadows and paſtures. But as he has not favoured us with a botanical deſcription of them, I can only form conjectures.

If the ſeeds of theſe two ſorts were carefully collected, and ſown ſeparately, without any mixture of the ſeed of other graſs, they would not only afford a greater quantity of fodder on the ſame ſpace of land, but the graſs would alſo be better, the hay ſweeter, and the verdure more laſting, than that of any other ſpecies. Mr. Miller recommends this particularly to every gentleman who would improve the verdure near his habitation.

The *annual Meadow Graſs (Pl. III, Fig.* 2) makes the fineſt of turfs. It grows every where by way ſides, and on rich ſound commons. It is called in ſome parts the Suffolk graſs, as I mentioned before. Mr. Stillingfleet ſays [u] he has ſeen whole fields of it in High Suffolk without any mixture o other

[u] *Miſcellaneous Tracts, p.* 383.

graſſes,

graſſes, and as ſome of the beſt ſalt butter we have in London comes from that country, it is moſt likely to be the beſt graſs for the dairy. He adds, in relation to this graſs, a remark he made on Malvern hill, where a walk that was made for the convenience of the water drinkers was covered with it in many places in leſs than a year, though he could not find a ſingle plant of it beſides in any other part of the hill. This was, doubtleſs, owing to the frequent treading, which, above all things, makes this graſs flouriſh; and therefore it is evident that rolling muſt be very ſerviceable to it. As the flowers and ſtems of this plant do not grow brown ſo ſoon as thoſe of other graſſes, nor do they cover the radical leaves ſo much, becauſe they are conſiderably ſhorter, this affords a more pleaſing turf than any other graſs.

Mr. Ray obſerves [x] of the common meadow graſs, that it is a ſlender and ſucculent plant, very agreeable to cattle, and a fattener of them; that it delights in a rich ſoil; and that it is not injured by being trodden under foot, and therefore it is common along the ſides of paths and roads. It ſpindles and ears in the ſpring, and continues to ſhoot during the whole ſummer.

As the next beſt to meadow graſs, Mr. Miller recommends [y] Ray's *Gramen avenaceum pratenſe elatius, paniculâ flaveſcente, locuſtis parvis* [z], Taller meadow Oat-graſs, with a yellowiſh pannicle, and ſmall huſks; which is the *Avena paniculâ laxâ, calycibus triſloris brevibus, floſculis omnibus ariſtatis*, Prod. Leyd. 66. Oat-graſs with a looſe panicle, three flowers in each empalement, which is ſhort,

x *Hiſt. Plant. p.* 1284.

y *Gardener's Dict.* Art. GRAMEN.

z RAII *Hiſt. ubi ſupra*; and *Synops. p.* 407.

and

and all the flowers having awns *. Mr. Ray likewiſe recommends [a] the *ſmooth mountain Oat-graſs (Pl. III. Fig. 3)*, which he calls *Gramen avenaceum montanum ſpicâ ſimplici, ariſtis recuroris*, found by Mr. Dale, upon Bartlow hills in Eſſex on the edge of Cambridgeſhire, in the borders of the corn fields between Newmarket and Exning, and on the chalk hills between Northfleet and Graveſend; and the *rough*, or *hairy Oat-graſs (Pl. III. Fig. 4)*, which he diſtinguiſhes by the appellation of *Gramen avenaceum hirſutum, paniculâ purpuro-argentiâ ſplendente*, and which abounds in the paſtures about the Earl of Cardigan's houſe at Twittenham in Middleſex. He alſo includes under this genus [b], all the *feſtuca* kinds, of which Mr. Stillingfleet gives the following account, in his obſervation on Graſſes, ſubjoined to his tranſlations of ſeveral ingenious tracts ſelected from the Tranſactions of the Academy of Upſal [c].

Sheeps Feſcue (Pl. III. Fig. 5.), which he diſtinguiſhes by the name of *feſtuca ovina*, is the graſs moſt eſteemed for the food of ſheep in Sweden, where they have not ſuch downs as we have.

a *Synops. p.* 405, 406.

b *Hiſt. Plant. p.* 1289; and *Synops. p.* 413.

c Page 384 *and ſeqq.*

* The *feſtuca avenacea hirſuta, paniculis minus ſparſis*, Rough oat-graſs (or *Drank*) with more compact panicles [g], grows on walls and hillocks, and on linchets or baulks in fields, and is what our country people commonly call *lob graſs*, or *hooded-graſs*. Mr. Liſle ſays [h] that this is the *fromental* of the French, and adds, that it is apparently of but little value; for it grows up in a ſingle culm from a root, without graſſy leaves, or herbage, about it's roots. As it generally grows on the pooreſt ſort of ground, we need not wonder that ſo much of it's ſeeds is commonly ſeen among the rye-graſs ſeed that is ſold; I ſuſpect it to be but an annual plant. Our huſbandmen endeavour rather to deſtroy, than propagate it.

g RAII *Synops. p.* 413.

h *Obſervations in Huſbandry, Vol.* II. *p.* 72.

Gmelin

Gmelin ſays[d], that the Tartars chooſe to fix during the ſummer in thoſe places where there is the greateſt plenty of this graſs; becauſe it affords a moſt wholſome nouriſhment to all kinds of cattle, but chiefly ſheep: and he obſerves, that the ſepulchral monuments of the ancient Tartars are moſtly found in places which abound with this graſs; which ſhews, adds he, that it has long been valued among them.

This graſs abounds in many parts of England and Wales, and particularly on all the fineſt ſheep paſtures in Herefordſhire, Oxfordſhire, Norfolk, &c[e]. Mr. Stillingfleet obſerves, that it is a very early graſs, and that, contrary to what Linnæus ſays, either ſheep or ſome other animals do eat the flowering ſtems of this graſs; for, when he ſearched for it upon Banſtead downs, he could ſee no part of it but the radical leaves, except among buſhes, near the hedges, where it was guarded from the ſheep.

Mr. Stillingfleet ſays, that he has always ſeen the *purple feſcue (Pl. III, Fig. 6)* along with the fine *bent* and ſilver *hair-graſs*, which will be ſpoken of hereafter, particularly on Banſtead downs, in great plenty, in a place incloſed in order to keep the ſheep out. From thence he is inclined to think, that this is the chief graſs all over the downs: but as the flowering ſtems in the other parts were intirely gone at the time of his viewing it, except along the hedges, he could not be certain in this reſpect.

After candidly declaring his want of knowledge of the qualities of the *flote feſcue (Pl. III. Fig. 7)* which he calls *Feſtuca fluitans* †, Mr. Stillingfleet quotes

d *Flor. Sibiric.*

e STILLINGFLEET, *ubi ſupra, p.* 385.

† There is a ſpecies of *flote graſs* which Mr. Ray calls *Gramen aquaticum geniculatum ſpicatum*, ſpiked flote graſs. It grows

quotes a curious paſſage in the Tranſactions of the Academy of Upſal [f], where the author of a piece entitled *Plantæ Eſculentæ* ſays, that the ſeeds of this graſs are gathered yearly in Poland, and from thence carried into Germany, and ſometimes into Sweden, and ſold under the name of *manna* ſeeds*; and that they are there much uſed at the tables of the great, on account of their nouriſhing quality and agreeable taſte. — Mr. Stillingfleet then adds, that one Mr. Dean, a very ſenſible farmer at Ruſcomb, in Berkſhire, aſſured him, "that a field of about four acres, which always lay under water, and was occupied by his father when he was a boy, was covered with a kind of graſs that maintained five farm-horſes, in good heart, from April to the end of harveſt, without giving them any other kind of food, and that it yielded more than they could eat. Some of it was carried to Mr. Stillingfleet, who found it to be the *flote feſcue*, with a mixture of the *marſh bent*: but whether this laſt contributes much towards furniſhing ſo good paſture for horſes, ſeems doubtful to him. They both throw out roots at the joints of the ſtalks, and are therefore likely to grow to a great length.

Linnæus ſays [g], that the bran of this graſs will cure horſes troubled with bots, if they are kept from drinking for ſome hours.

in watery places, multiplies immenſely, and has exceeding long trailing ſtalks, which, like the ſort mentioned by Mr. Stillingfleet, put forth roots at their very numerous joints, and do not riſe much in height. *Hiſt. Plant. p.* 1264.

* There is a clammineſs on the ear of the *flote feſcue*, when it's ſeeds are ripe, which taſtes like honey, as Mr. Stillingfleet ſays he has often found; and for this reaſon, perhaps, they are called manna ſeeds.

[f] *Amænit. Academ. Tom.* III.

[g] *Flor. Suec. art.* 95.

In the index of dubious plants at the end of Ray's *Synopſis*, mention is made of a graſs called *Gramen caninum ſupinum longiſſimum*, longeſt ſupine Dog's graſs, which grows at Maddington in Wiltſhire, and in ſome parts of Wales, to the length of twenty four feet, and is uſed for the fattening of hogs. It's ſtalks are of the creeping kind, and touch the ground at ſeveral of their knots; for they do not riſe much in height. Mr. Stillingfleet thinks it the *flote feſcue*, and rightly adviſes farther inquiries concerning it. But he does not ſeem here to have conſulted Mr. Worlidge, who ſays [h], ſpeaking of this graſs, that it is extraordinarily ſweet, but not ſo eaſily propagated as hath been imagined; the length thereof being occaſioned by the waſhing of a declining ſheep-down, from whence haſty rains bring with them much of the fatneſs of the dung of the ſheep, which ſubſides upon the ſmall meadows where this graſs grows: ſo that in ſprings not ſubject to theſe ſhowers, or on lands not enriched by that fertiliſing ſoil brought down to them, this graſs does not thrive ſo well.

The *Vernal graſs* (*Pl. III. Fig.* 8) which Mr. Stillingfleet calls *Anthoxanthum odoratum*, and which is at leaſt a ſpecies of Ray's *Gramen vernum ſpicâ brevi laxâ* [i], and of C. Bauhin's *Gramen vernum pratenſe ſpicâ flaveſcente* [k], Vernal graſs with a looſe yellowiſh ſpike, is one of the earlieſt graſſes, and grows very commonly in all our meadows, paſtures, and other grounds. It is found in plenty upon thoſe paſtures which ſheep are fond of, and from whence excellent mutton comes; and therefore it is moſt likely to be a good graſs for ſheep paſtures; Mr. Stillingfleet ſays, he has found it on

h *Syſtema Agriculturæ*, *p.* 32.

i *Hiſt. Plant. p.* 1268, and *Synopſ. Stirp. Brit. p.* 398.

k *Pin.* 3. *Th.* 44.

all kinds of grounds, from the moſt ſandy and dry to the moſt ſtiff and moiſt, and even in bogs. It is very plentiful in the beſt meadows about London, *viz.* towards Hampſtead and Hendon; and it's ſeeds may be gathered very eaſily, as it ſheds them upon the leaſt rubbing. This graſs gives a grateful odour to hay.

Mr. Liſle remarks [l], that the *Gramen parvum repens purpureâ ſpicâ*, ſmall creeping graſs with a purple ſpike, is no indication of bad ground, though it be a very bad graſs. Ray ſays [m], that it is very common in paſtures. — There ſeems to be a great ſweetneſs in it. — The ſame may be ſaid of the *gramen criſtatum*, or ſmooth creſted graſs, which alſo abounds every where in our meadows and paſtures [n].

The *meadow fox-tail graſs*, (*Pl. III. Fig.* 9.) *Gramen alopecuroides* [o], abounds in our beſt meadows about London, and makes very good hay; perhaps the beſt of any that is brought to market here. Mr. Stillingfleet obſerved in the ſpring of laſt year (1762), a meadow near Hampſtead, which conſiſted of this graſs chiefly, with ſome of the vernal graſs and the corn brome graſs: but it is ſcarce in many parts of England, particularly in Herefordſhire, Berkſhire, and Norfolk; though it might be gathered at almoſt any time of the year, even from hay-ricks, as it does not ſhed it's ſeeds without rubbing, which is the caſe of but few graſſes.

The *water fox-tail* (*Alopecuroides paludoſum* [p]) is alſo found in ſuch meadows about London as are found and lie under water in the winter. Mr. Stil-

l *Obſervations in Huſbandry*, Vol. II. *p.* 38.

m *Hiſt. Plant. p.* 1286.

n *Ibid. p.* 1289. and *Synops. p.* 398.

o *Ibid. p.* 1296. and 396.

p RAII, *Hiſt. Plant. p.* 1266.

lingfleet

Ingfleet thinks it may, perhaps, be a proper graſs to ſow on ſuch grounds.

Mr. Stillingfleet has always found the fine *bent* graſs (*Pl. III. Fig.* 10), which he names *Agroſtis capillaris*, in great plenty on the beſt ſheep paſtures, as on Malvern hills, Bagſhot heath, and all the high grounds in Herefordſhire, Berkſhire, Oxfordſhire, and Norfolk, and other places remarkable for good mutton.

The ſame may be ſaid of the *mountain Hair graſs* (*Pl. III. Fig.* 11), which he calls *Aira flexuoſa*; and of the *Silver Hair graſs* (*Pl. III. Fig.* 12), which is his *Aira Caryophillea*.

The *quaking graſs*, *Cow-quake*, or *Lady's Hair*, as it is called in ſome places, is the *Gramen tremulum maximum*, of C. Bauhin [q], and J. Ray [r], and the *Briza ſpiculis cordatis, floſculis ſeptendecim*, Hort. Cliff. 23. *Briza* with heart-ſhaped little ſpikes, and ſeventeen flowers in each. Though a very poor and ſlender graſs, Mr. Liſle thinks it no indication of poor land where it grows [s]: for, as Mr. Ray obſerves, it is the moſt common graſs of any in all the paſture grounds throughout England.

Mr. Miller deſcribes it [t] as having an annual root, which ſends up many broad hairy leaves, between which ariſe ſlender ſtiff ſtalks, from a foot to near two feet high, dividing upward into a large looſe panicle, garniſhed with heart-ſhaped ſmall ſpikes, each having about ſeveenteen ſmall floſcules, or florets; and theſe, after the flowers are paſt, are ſucceeded by a ſingle ſeed. The heads hang by ſlender long foot ſtalks, which are moved by every wind, ſo that they generally appear ſhaking; from whence it had the name of *quaking*

q Note *p.* 2.
r *Hiſt. p.* 1274; and *Synops. p.* 412.
s *Obſervations in Huſbandry, Vol.* II. *p.* 37.
t *Gardener's Dict.* Art. GRAMEN

graſs. There is a ſmaller ſpecies of it, which is a native of England; but, I believe, of no greater value than the former. Theſe graſſes come to head in May: and this gave riſe to the Engliſh Proverb, *May, come ſhe early come ſhe late, makes the Cow quake.*

Matweed, (*Gramen Sparteum*) is of the *broom* kind, and delights in ſandy places, near the ſea. Even clouds of ſand blown over it do not hurt, but, on the contrary, promote, it's growth. It has been of excellent ſervice in fixing looſe ſands, as, if I have been rightly informed, it once did very remarkably in Norfolk. Of ten ſpecies of this plant, which Mr. Ray diſtinguſhes[u], the following are the chief. 1, *Spartum Plinii,* ſive *Juncus Hiſpanicus,* the true matweed of Pliny, or Spaniſh broom; 2, *Gramen ſparteum paniculâ brevi folliculo inclusâ,* Hooded matweed; 3, *Gramen ſparteum marinum Anglicanum,* Engliſh ſea mat-weed, or marram; 4, *Spartum maximum maritimum Hollandicum, ſpicâ ſecalinâ* the greateſt Holland matweed, with a rye ſpike; 5, *Gramen ſparteum pennatum,* Feather-graſs; and 6, the *Gramen ſparteum juncifolium,* or *ſpartum parvum,* ſmall matweed.

Mr. Stillingfleet ſays, that the beſt mutton he ever taſted, next to that which comes from hills where the purple and ſheep's feſcue, the fine bent, and the ſilver hair graſſes abound, was fed upon the *creſted dog-tail graſs* (*Pl. III. Fig.* 13), which he and Mr. Hudſon call *Cynoſurus criſtatus.* He therefore rightly judges it proper for parks; and confirms this opinion, by adding, that he knows a park where this graſs abounds, which is famous for excellent veniſon. — It makes a very fine turf upon dry, ſandy, or chalky ſoils: but unleſs it be ſwept over with the ſcythe, it's flowering ſtems

[u] *Hiſt. Plant. p.* 1259, *et ſeqq.*

will

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig.



Greate Meadow Graſs. Annual Meadow Graſs. Smooth Oat Graſs. Hairy Oat Graſs. Sheeps Fescue Graſs. Purple Fescue Graſs. Flote Fescue Graſs. Vernal Graſs. Meado -tail G

Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 11. Fig. 12. Fig. 13.



Graſs. Sheeps Fescue Graſs. Purple Fescue Graſs. Flote Fescue Graſs. Vernal Graſs. Meadow Fox-tail Graſs. Fine Bent Graſs. Mountain Hair Graſs. Silver Hair Graſs. Crested Dogs-tail Graſs.

will look brown; as is the caſe of all graſſes which are not fed by a variety of animals: for that ſome animals will eat the flowering ſtems, is evident from commons, where one ſcarcely ſees any part of the graſſes, except the radical leaves.

Mr. Miller thinks the *cock's-foot graſs* (Ray's *Gramen dactylon*, Hiſt. p. 1271), the *Capon's-tail graſs* (Ray's *Gramen murorum ſpicâ longiſſimâ*, Hiſt. p. 1286), and the *millet* graſſes (*Gramina miliacea*), too coarſe to deſerve attention in England; though ſome of their ſpecies are very uſeful in the warm parts of America, where there is a great ſcarcity of finer graſs, and even much better adapted for ſuch climates, than any of our European graſſes; becauſe many of them lie flat on the ground, and emit roots from their joints, by which means they are well prepared for heat; of which their large and juicy ſtalks likewiſe enable them to bear an extraordinary degree.

The purple, or, as it is commonly called, *red, meadow trefoil*, which is C. Bauhin's *Trifolium pratenſi purpureum*, has already been ſufficiently diſtinguiſhed * from the common red clover, or red honeyſuckle (Ray's *Trifolium purpureum majus, pratenſi ſimile*, Syn. 328), which, though Mr. Liſle thinks otherwiſe [a], is undoubtedly a native of England, as is manifeſt from it's ſpontaneous and flouriſhing growth on the top of many mountains, particularly in even the moſt northern parts of Scotland, where no mortal ſurely ever dreamt of cultivating it. The ſpecies called yellow meadow trefoil, or hop-clover, is C. Bauhin's *Trifolium pratenſe luteum, capitulo lupuli, vel agrarium*; and the ſmaller kind of this, commonly called none-ſuch, or black-ſeed, is the *Trifolium luteum, lupulinum, minimum.*

* See *p.* 202.

a *Obſervations in Huſbandry*, Vol. II. *p.* 40.

minimum. M. Duhamel [b] rightly prefers the firſt of theſe ſorts for artificial paſtures, and obſerves, that it is the only ſpecies now cultivated in France, for that purpoſe.

Our meadows afford us the white meadow trefoil, honeyſuckle graſs, or white Dutch clover, which is the *Trifolium pratenſe album of* C. Bauhin, and by far the beſt ſort of clover for laſting paſtures, becauſe it is the ſweeteſt and moſt abiding of all the plants of this kind.

This white clover, beſides being perennial, ſends forth roots and ſhoots from every joint of it's trailing branches, for it does not riſe high, and thereby forms the cloſeſt ſward of any of the artificial graſſes. It is exceeding ſweet food for all ſorts of cattle: for which reaſon a quantity of the ſeeds of this plant ſhould always be ſown with the other graſs ſeeds, on whatever land is intended to be laid down for paſture. The uſual allowance of this ſeed is eight pounds to an acre. But it never ſhould be ſown with corn; becauſe this will weaken it, ſo that it will be ſcarcely worth ſtanding. And yet, as Mr. Miller obſerves [c], ſuch is the covetouſneſs of moſt farmers, that they will not be prevailed on to alter their old cuſtom of laying down their ground with a crop of corn; though they looſe twice the value of that corn, by the poorneſs of the graſs, which will not then come to a good ſward: and one whole ſeaſon is alſo loſt: for if this ſeed is ſown in the ſpring, without corn, their will be a crop of hay to mow by the middle, or latter end of July, and a much better after-feed for cattle the following autumn and winter, than the graſs which is ſown with corn will produce the ſecond year. It may alſo be

[b] *Eléments d'Agriculture, Tom.* II. *p.* 141.

[c] *Gardener's Dict.* Art. TRIFOLIUM.

ſown

ſown with graſs ſeed in autumn, in the manner before directed [d] for the common red clover; and if the ſeeds grow kindly, this autumnal ſowing will afford a good early crop of hay the following ſpring. If the ground is well rolled after this crop is taken off, the clover will mat cloſe upon it, and form a thick ſward.

Conſiderable quantities of the ſeeds of this white clover are imported hither annually from Flanders, by the way of Holland; from whence it has received the name of *Dutch* clover: not that it is more a native of that country, than of this; for it is very common in the paſtures all over England; but the ſeeds of it were never collected here, for ſowing, till of late years; nor are there yet many perſons in this kingdom who ſave them, though they may be ſaved with the ſame eaſe, and in the ſame manner, as is practiſed for the red clover. Every farmer who would improve his land, ſhould therefore ſow an acre or two with this white clover, unmixed, merely for the ſake of it's ſeeds, which are often ſold at a great price. He will by this means ſave the expence of buying them; and he will eaſily find purchaſers for any quantity he may have to ſpare.

I do not know that the narrow leaved plantain, or *ribwort*, (*Plantago anguſtifolia*) hath ever been cultivated purpoſely for the food of cattle. It grows, indeed, in almoſt all paſtures: but, as it will thrive upon very dry ſpots, becauſe it ſtrikes a deep root, it may probably deſerve farther trial.

The reverend Dr. Eliot, whom I ought not to mention without paying a juſt tribute of reſpect to his memory, recommends two ſorts of graſſes, natives of North America, of which he lately ſent over a parcel of the ſeeds to the London Society

[d] Page 203.

for

for the Encouragement of Arts, &c. by whom they have been diſtributed here, ſo that we may hope ſoon to know their ſucceſs in this country, and of which he has given the following account in his Eſſays upon Field-Huſbandry in New England [e].

"One of theſe graſſes is called *Herd-graſs*, from "one Herd, who firſt diſcovered it in a marſh in "Piſcataqua, and afterwards propagated it: and "it is likewiſe called *Timothy-graſs*, from the name "of the perſon who firſt propagated it in Penſyl-"vania. The other, which is termed *Fowl-mea-"dow-graſs*, was brought into a piece of poor "meadow in Dedham, by ducks and other wild "water-fowls; from whence it is called by this "odd name. It is ſuppoſed to be brought into the "meadows at Hertford by the annual floods, and "is there called *Swamp-wire-graſs*. Of theſe two "ſorts of natural graſs, the *fowl-graſs* is much "the beſt. It grows tall and thick, and makes a "ſofter and more pliable hay than herd-graſs, "and conſequently will be fitter for preſſing, in "order to ſhip off with our horſes: beſides which, "it is a good graſs, and yields a good burthen, "*viz.* three loads to the acre. It muſt be ſowed "in low moiſt land. Our drained land, when it "is of ſufficient age, is very agreeable to this ſort "of graſs. As the ſeed is very fine, there is "danger of ſowing it too thick, as ſome have "done, ſo as to come up thick like hair. This is "a loſs of ſeed, and prejudicial to the graſs.

"When you bring to a ſwamp by flowing, "have killed your bruſh, ditched your land, and "and got it a little dry, you may ſow your ſeed "among the trees and bruſh: it will come up, "eſtabliſh itſelf, and prevent other bad graſs from

[e] Page 57, 68, 92.

"taking

" taking poſſeſſion: then you may clear off " the wood and bruſh at your leiſure, and you " will have good graſs to mow as faſt as you can " clear the land. I have ſeen it grow knee-high, " when the dead bruſh was very thick.

" This graſs has another good quality, which " renders it very valuable in a country where help " is ſo much wanting: this is, that it will not " ſpoil or ſuffer, although it ſtand beyond the " common time for mowing. Clover will be loſt " in a great meaſure, if it be not cut in the pro- " per ſeaſon; and rye graſs, which we commonly " call Engliſh graſs, will be little better than rye " ſtraw, if it ſtands too long: but this fowl-graſs " may be mowed at any time, from July to " October.——This I wondered at: but viewing " ſome of it attentively, I think I have found the " reaſon of it. When it is grown about three " feet high, it then falls down, but doth not rot " like other graſs when lodged; and in a little " time after it is thus fallen down, it puts forth a " new branch at every joint. Now to maintain " this young brood of ſuccors, a plentiful courſe " of ſap muſt be conveyed up through the main " ſtem, or ſtraw; and by this means the graſs is " kept green, and fit for mowing, during all this " long period.—— I find by experience, that the " beſt time to mow it, is when theſe new branches, " or ſuccours, have attained to their full growth.

" One of my ſons told me, that, at New-Fair- " field, he ſaw ſome ſtalks of it, which the people " told him was cut in October. He pulled out " ſome of the hay: it looked green, and had a " good ſmell. This is a great convenience in time " of ſickneſs, or any other caſualty, whereby we " may be hindered from mowing in ſeaſon.

" This good property renders it a fit ſort of " graſs for a new country, where we often have

" buſineſs

" buſineſs crowd too hard upon us. —— It is ſo " peculiarly agreeable to deer, that they prefer " it to every other food, not excepting even corn."

HAVING now deſcribed the ſeveral ſorts of graſſes fitteſt for paſture, I cannot but join with Mr. Miller, when he remarks[f], that " there is no " part of huſbandry, of which the farmers are, " in general, more ignorant, than of this. Moſt " of them ſuppoſe, that when an old paſture is " plowed up, it can never be brought to have a " good ſward again: ſo their common method " of managing their land after plowing, and get- " ting two or three crops of corn, is to ſow with " their crop of barley, ſome graſs ſeeds (as they " call them); that is, either the red clover, which " they intend to ſtand two years after the corn is " taken off the ground, or rye-graſs mixed with " trefoil; but as all theſe are at moſt but biennial " plants, whoſe roots decay ſoon after their ſeeds " are perfected; ſo the ground, having no crop " upon it, is again plowed for corn: and this is " the conſtant round which the lands are employ- " ed in, by the better ſort of farmers; for I have " never met with one of them, who had the leaſt " notion of laying down their land to graſs for " any long continuance: therefore the ſeeds " which they uſually ſow, are the beſt adapted " for this purpoſe.

" But whatever may have been the practice of " theſe people, I hope," continues he, " to prove, " that it is poſſible to lay down land, which has " been in tillage, with graſs, in ſuch manner as " that the ſward ſhall be as good, if not better, " than any natural graſs, and of as long duration. " But this is never to be expected in the common " method of ſowing a crop of corn with the graſs

[f] *Gardener's Dict.* Art. PASTURE.

ſeed;

"ſeed; for wherever this has been practiſed, if the "corn has ſucceeded well, the graſs has been "very poor and weak; ſo that if the land has "not been very good, the graſs has ſcarcely been "worth ſtanding: for the following year it has "produced but little hay; and the year after, the "crop is worth little, either to mow or feed: nor "can it be expected it ſhould be otherwiſe; for "the ground cannot nouriſh two crops."

In conſequence of this, Mr. Miller preceeds to give the following directions for the management of paſture land.

When ground is laid down for graſs, no crop of any kind ſhould be ſown with the ſeeds, and the land ſhould be well plowed, and cleaned from weeds. The beſt ſeaſon to ſow the graſs-ſeeds, upon dry land, is about the middle of September, or ſooner, if there be an appearance of rain; becauſe the ground being then warm, if ſome good ſhowers of rain fall after the ſeed is ſown, the graſs will ſoon make it's appearance, and get ſufficient rooting in the ground before winter, not to be in danger of being turned out by the froſt; eſpecially if the ground is well rolled before the froſt comes on. If the graſs comes up well, this rolling ſhould be performed towards the end of October, or the beginning of November, and repeated again in the beginning of March. The ſward will, in this caſe, be cloſely joined at the bottom, and a good crop of hay may be expected the ſame ſummer. In cold lands, which lie very open and expoſed, it will be right to ſow the ſeeds a month earlier, that the graſs may have time to get good rooting, before the cold ſeaſon comes on to ſtop it's growth. If the ground cannot be prepared for ſowing in autumn, it may be ſowed in the middle or latter end of March, according as the ſeaſon is early or late. The danger

of

of ſowing late, is dry weather, eſpecially if the ſoil be light and dry. It will then be proper to roll the ground well, ſoon after the ſeeds are ſown; to ſettle the ſurface, and prevent it's being blown away, together with the ſeeds, as has frequently happened, by the high winds in March.

The farmer's judgment, if he attends to the above account of the beſt and moſt profitable ſorts of graſſes, will direct him ſufficiently in his choice of ſeeds, and enable him to ſuit each particular ſpecies to it's proper ſoil. The quantity fitteſt to be ſown, will depend on the nature of the ſeed; that is to ſay, on it's being light and chaffy, or on it's being naked; much more of the former being neceſſary, than of the latter. If it be intended to mix clover with the graſs, the ſeeds of the clover ſhould be ſown alone, after thoſe of the graſs; becauſe, as they are by much the heavieſt, they would ſoon ſeparate from the graſs ſeeds, and ſink to the bottom of them, in the ſeed-man's apron, or whatever other vehicle he makes uſe of, and conſequently would be ſown unequally.

After the ſeeds are ſown, the ground ſhould be harrowed lightly to bury them: but this ſhould be done with a ſhort toothed harrow; for otherwiſe the ſeeds will be buried too deep. If the ſurface of the ground is dry, it ſhould be rolled, two or three days after ſowing, with a barley roller, to break the clods, and ſettle the ground; which will prevent the ſeeds from being removed by the wind.

When the ſeeds are come up, the ground ſhould be weeded: otherwiſe the weeds will increaſe, ſo as to keep down the graſs, and ſtarve it: and if they are ſuffered to remain till they have ſhed their ſeeds, they will over-run the land, and entirely

tirely deſtroy the graſs. One of the principal parts of huſbandry, is never to ſuffer weeds to grow.

If the ground is rolled two or three times, at proper intervals, after the graſs is up, it will make it form a thicker bottom: for as the white clover puts out roots from every joint of the ſtalks which are near the ground; the roots will mat ſo cloſely together, as to cover the whole ſurface of the ground with a ſward capable of reſiſting any common drought.

After the ground has been brought to a good ſward, the way to preſerve it ſo, is to roll it conſtantly every ſpring and autumn, with a heavy roller, and to keep it clear from all ſorts of weeds. Dreſſing of theſe paſtures every third year, is alſo neceſſary; for otherwiſe it cannot be expected that this ground, which has not the benefit of tillage, ſhould contiuue to produce good crops: and another thing proper to be obſerved, is to change the ſeaſons of mowing, and not to mow the ſame ground every year; but to mow one ſeaſon, and feed the next: for ground that is mowed every year will ſoon be exhauſted, if it has not a conſtant ſupply of manure.

It is plainly owing to our farmers not diſtinguiſhing graſſes which are annual, from thoſe which are perennial, that land which has been in tillage is not brought to a good turf again, in the common method of huſbandry: for annual and biennial graſſes will ſoon decay, and nothing can be expected to ſucceed them, but what will grow naturally, except, perhaps, on ſome ſpots, where their ſeeds may chance to have ripened and ſown themſelves. This, added to the covetous method of laying down the ground with a crop of corn, has been the true cauſe of the decreaſe of paſture in many parts of England, where it is now much more valuable than arable land.

SECT.

SECT. III.

Of the Improvement of Paſtures already under Graſs.

MANY excellent meadows and paſture grounds are ſo over-run with buſhes, ſhrubs, weeds, mole hills, ant hills, and the like, that great part of them is oftentimes wholly loſt, and a conſiderable portion of the remainder cannot be mowed but in patches, to the manifeſt detriment of the husbandman, whoſe firſt care, in ſuch caſe, ſhould be, the removing of theſe obſtacles.

Mr. Platt's very good and eaſy directions for grubbing up ſhrubs and buſhes, by means of a ſufficiently large and ſtrong dung-fork, driven into the ground, at about ſix inches diſtance from the root intended to be torn up, then raiſed by laying under it a ſtone or log of wood, and afterwards pulled down by a rope faſtened to the upper end of it's handle, have been given in the firſt volume of this work *, and will be found effectual to wrench up whole buſhes, with their roots.

The reverend Dr. Eliot adviſes, from his own experience, when any buſhy growth is to be extirpated by cutting it down, always to chooſe for this buſineſs a cloudy day [a], in June, July, or Auguſt; becauſe the ſtumps will bleed more freely at ſuch a time, and conſequently die ſooner, than when the hot rays of the ſun ſhine upon them, and dry up the ſap. He adds, that *it ſhould be in the old moon, on the day that the ſign is in the heart*; and inſtances, in ſupport of this, facts, which, ridiculed and exploded as all ſuch notions now are, cannot be doubted, as he aſſerts them, however elſe they

* Page 221.

[a] *Eſſays on Field-Husbandry in New England, p.* 16.

may

may be accounted for. — I ſhall give them in his own words; and leave to critics the office of carping at them; and to the modern learned the taſk of diſproving his reaſons for what he relates, if either of them ſhould chooſe to take offence thereat.

"Laſt year, ſays he [b], in June or July, I forget "which, I ſent a man to make a trial. In going "to the place, ſome of the neighbours, under-"ſtanding by him the nature of the buſineſs he "was going about, and the reaſon of his going "at that point of time, went alſo to their land, "and cut buſhes alſo on that day. Theirs "were tall buſhes, which had never been cut: "mine were ſhort ones, which had been often "cut, but to no purpoſe, unleſs it was to increaſe "their number. The conſequence was, that, in "every place, it killed ſo univerſally, that there is "not left alive, ſcarce one in an hundred. The "trial was made in three or four places, on that "ſame day. In July or Auguſt, on the critical "day, another ſwamp was cut; the bruſh was, "for the greateſt part, ſwamp button wood, the "moſt difficult to ſubdue of any wood I know. "I have been lately to ſee it, and find the de-"ſtruction of theſe buſhes not ſo univerſal as "among alders and other ſorts of growth. It is "hard to ſay how many of them remain alive: it "may be one third or a quarter part. All that I "can ſay, with certainty, is, that they are now "few, compared with what there was laſt year. I "did not know, but that thoſe which are alive, "might be ſuch as came up ſince: but, upon "examination, I found the laſt year's ſtumps, and "could plainly ſee where they had been cut off. "This was not becauſe the ſeaſon was better when

[b] *Ibid, p.* 123.

" there was ſuch ſucceſs: for in this laſt mention-
" ed piece of ſwamp, there were ſundry ſpots of
" alders and other ſorts of buſhes, and they ſeem to
" be as univerſally killed as the others. The reaſon
" why the ſame ſucceſs did not attend the cutting
" of the button buſhes, as of the other ſorts, I
" ſuppoſe to be from the ſtubborn nature of this
" kind, which would not yield to any cutting.
" The ordinary way has been to dig or plow it
" up by the roots: ſo that, conſidering the nature
" of this buſh, I have had great ſucceſs. The
" ground being very boggy, thoſe who mowed
" them were obliged to cut them very high, which
" was another diſadvantage.

" To ſhew ſuch a regard to the ſigns, may in-
" cur the imputation of ignorance or ſuperſti-
" tion: for the learned know well enough, that
" the diviſion of the Zodiac into twelve ſigns,
" and the appropriating theſe to the ſeveral parts
" of the animal body, is not the work of nature,
" but of art; contrived by aſtronomers, for con-
" venience. It is alſo as well known, that the
" moon's attraction hath great influence on all
" fluids.

" It is likewiſe well known to farmers, that
" there are ſeaſons when buſhes, if cut at ſuch a
" time, will univerſally die. A regard to the
" ſign, ſo far as it ſerveth to point out and di-
" rect to the proper time, becomes therefore
" worthy of obſervation.

" A farmer of good credit told me, that he
" had found by experience, that buſhes cut with
" a ſharp tool will die ſooner than when cut with
" a dull one. This ſeems agreeable to reaſon:
" for a ſharp ſcythe leaves the mouths of the ſap
" veſſels all open, by which means they bleed
" more plentifully; but a dull inſtrument bruiſes

" the

" the part, and, in a degree, cloſes up the " wound*.

" Elder buſhes are ſtubborn, and hard to ſub- " due: yet I know by experience, that mowing " them five times in a year will kill them [c]."

The traſh thus rooted up, or cut down, but rooting of it up is by much the beſt way, ſhould afterwards be dried and burnt, and the aſhes proceeding therefrom will be of great ſervice to the ground, if ſpread upon it juſt before the autumnal rains.

The way to remove mole hills and ant-hills, which are not only diſagreeable to the ſight, but detrimental to the paſture, and a great hinderance to the mowing of the graſs, eſpecially where they are numerous, is, particularly in regard to the latter, either to divide the turf which grows over them, into three parts, with a ſpade, or other inſtrument, then to pare it off each way, to dig out the middle or core of the hills, to ſpread this mould over the other ground, to leave the holes open all the winter, that the ants may be killed, to lay the turf down again in the ſpring, and to roll thoſe ſpots after the re-inſtated turfs are ſettled, and their graſs has taken freſh root; or, which is a more expeditious method, to ſcoop them out at once, with what Mr. Bradley calls [d] a ſcolloped mole-hill plough, made in the following manner.

From *a* to *a* (*Fig.* 1. *Plate* IV.) is an iron plate, about five inches over, and above an inch thick at the back. *b b* is the ſcolloped ſpade, or tongue, of the plough, and about a foot over at the wideſt part. This, from the ſharp point, grows

* For a ſimilar reaſon it is that gun-ſhot wounds never bleed ſo freely as thoſe which are made with a ſharp cutting inſtrument.

[c] *Ibid. p.* 17.

[d] *Complete body of Huſbandry, p.* 47.

thicker by degrees, till it comes to the back, which ſhould be a full inch thick. The iron muſt be well hardened, and very ſharp at the edges. *c c* is the paring plate, which ſhould be very ſharp on the fore edge, and, with the ſcolloped ſpade, ſhould be four feet long, from *a* to *a*. *d d* are iron ſockets, in which are fixed the plough handles, or ſtilts, *e e*. At *a a* are foot-links to ſet the harneſs on, for one horſe, or two horſes lengthwiſe, to draw by.

When this plough is uſed, the point of the ſcolloped ſpade muſt be ſet to the bottom of the hill, by raiſing the plough ſtilts, ſo that it may go into the ground; and when the hill is near cut through, the point ſhould be raiſed up again, by weighing a little on the ſtilts.

The hollow left by this plough will receive the rain as it falls, and this will drown the remaining ants.

After the mole and ant hills, and other inequalities have been thus taken off, the beſt way is to carry them to a corner of the field, there to break them well to pieces, and mix them with a conſiderable portion of lime, which will effectually deſtroy every remains of the ants, and convert the whole to good manure, which may then be profitably ſpread all over the ſurface of the ground. The ſpots on which the mole, or ant, hills ſtood, ſhould be looſened with a ſpade, then mixed with lime or other manure, and afterwards be laid down with clean graſs ſeeds.

This method is the moſt adviſable of any, becauſe a fine graſs will be raiſed in thoſe places, inſtead of the coarſe benty growth which occupied them before.

Draining of land is likewiſe a great improvement: for though meadows and paſtures which are capable of being overflowed, produce a greater quantity

quantity of herbage, than dry ſoils do; yet, where the wet lies too long upon the ground, the graſs will be ſour and extremely coarſe; and if great care is not taken to drain ſuch land, it will yield leſs and leſs graſs, will ſoon be over-run with ruſhes and flags, and will then be reduced to little value. The ſoil moſt liable to this, is cold ſtiff clay, where the water cannot penetrate, but is contained, as in a diſh: ſo that the wet which it receives in the winter, continues till the heat of the ſun exhales it.

The beſt method of draining theſe lands, is to cut ſeveral trenches a-croſs the ground, in thoſe places where the water is apt to lodge, and other larger drains to carry it off from them, to either ponds or rivers in the lower parts of the land. Theſe drains need not be very large, unleſs the ground lie quite low, and is ſo ſituated as not to be near any rivulet, or running ſtream, to which the water can be conveyed. In this caſe, indeed large ditches ſhould be dug, at proper diſtances, in the loweſt part of the ground, to contain the water. The earth taken out of the ditches ſhould likewiſe be carried to a corner of the field, and there be mixed with lime: after which it ſhould be ſpread on the land, in ſuch manner as to form a gentle declivity, on all ſides, from the middle of the field.

Meadows which lie flat, and whoſe ſurface conſiſts of a looſe earth which affords an eaſy paſſage to water, whilſt a ſtiff ſoil underneath retains it, are apt to grow ſour and cold, by means of the water ſo retained. For theſe, the under-ground drains before directed[e] are the moſt proper.

When theſe precautions have been taken, and the abovementioned obſtacles removed, the ground

[e] Vol. I. *p.* 177.

muſt be cleared from every plant which is not intended to make a part of the paſture. But as ſome of theſe, though here properly termed weeds, by way of diſtinguiſhing them from the graſs, may be uſeful in other places, and on other occaſions; I ſhall treat ſeparately of ſuch of them as require any particular means, in order to their being deſtroyed, or by the propagating of which, elſewhere, the farmer may be benefited. — The firſt that I ſhall ſpeak of, is one of the moſt difficult to extirpate.

Furze, *whins*, or *gorſe*, to which C. Bauhin and Mr. Ray, gives the name of *Geniſta ſpinoſa*, and which Dr. Linnæus and Mr. Miller call *Ulex*, propogate themſelves ſo rapidly, by ſowing their ſeeds, that, where they are once eſtabliſhed in a ſpot of ground, they ſoon over-ſpread the whole place: for, as the ſeeds ripen, their pods are opened by the warmth of the ſun, and they are thrown out with an elaſtic jerk, to a conſiderable diſtance all around. There they vegetate, and the ground is ſoon filled with young plants, which are not eaſily deſtroyed after they have taken good root. The only way of extirpating them, is by paring off and burning the ſurface of the ground: the method of doing which has already been ſufficiently explained. This is by ſo much the more adviſable, as theſe ſeeds will otherwiſe remain a long while ſound in the earth, and grow whenever they are brought up by plowing; and alſo becauſe the ſmalleſt fragments of this plant will ſtrike out freſh roots, and ſhoot up anew. But when a good thickneſs of the ſurface is pared of, and burnt, the ſeeds are ſo effectually deſtroyed, and the roots are killed to ſo conſiderable a depth, that neither can again give riſe to new plants: and if a few of theſe do appear, a ſummer fallow will put an entire end to their growth. Their increaſe may likewiſe

wiſe be prevented by good manuring, with marle, chalk, or lime, eſpecially in ſandy ſoils, which are the moſt apt to produce this plant, and which are at the ſame time the moſt benefited by thoſe helps.

However, thanks to neceſſity, that fertile mother of invention, this very plant, formerly deemed a great nuiſance, is now cultivated to advantage on light, ſandy, dry ſoils; which would otherwiſe turn to little account. The tops of the common Engliſh furze, bruiſed a little to take of or to blunt their prickly tips, have been found to be excellent fodder, even for lean ſickly beaſts, and particularly horſes, which they have frequently recovered, and plumped up, in a ſhort time. This cuſtom is much practiſed in ſeveral foreign countries [f], where furze are cultivated purpoſely for fodder, and the peaſant thinks it a happineſs, that his breaking their ſpikes with a mallet enables him to give this wholſome green food to his cattle in the winter, when, often, no other ſucculent plant can be had, fit for that uſe. The mills which Sir Capel Hanbury has lately erected for this end in Wales, with a patriotic ſpirit well ſuited to his diſtinguiſhed zeal for the public welfare, will ſave the countryman that laborious taſk, and prove highly beneficial to thoſe who follow his judicious example.

When furze are raiſed on purpoſe for the food of cattle, and eſpecially on ſoils like the abovementioned, their ſeeds ſhould be ſown in February, March, or April, and the ground ſhould be prepared as for barley. Six pounds of them will be ſufficient for an acre of land; and they ſhould be but barely covered over. The young plants muſt be preſerved from cattle during the firſt year, and they will be fit to mow or cut in the

[f] *Maiſons Ruſtiques, Tom.* I. *p.* 640.

next. October is the proper time to begin cutting them. They will continue to ſhoot till Chriſtmas, and be fit for uſe till March. Horſes eat them as readily as they do hay, after they have been bruiſed or pounded ſo as to take off their ſharp points; and it is ſaid, that an acre of ground will produce fifteen tons of this fodder, and that it will go as far as an equal quantity of hay. Some mix the bruiſed furze with chopped ſtraw; an hundred of ſtraw to a ton of furze: but only the growth of the year ſhould be cut for cattle.

Poor hungry gravelly ſoils, which would not have let for five ſhillings an acre, have been rendered worth twenty ſhillings a year, by ſowing them with furze ſeed, in places where fuel has been ſcarce; this being frequently uſed, for heating ovens, burning lime and bricks, and alſo for drying malt: but it is not worth practiſing in countries where fuel of any kind is cheap, or upon ſuch land as will produce good graſs, or corn. Mr. Miller mentions it[g] in this light, only to ſhew, that the pooreſt lands may be ſo managed, as to bring an annual profit to their proprietors.

Some years ago, the common furze uſed to be much ſown for hedges about fields, and, where the ſoil was light, the plants ſoon became ſtrong enough for a fence againſt cattle: but as theſe hedges grew naked at the bottom in a ſhort time, and the plants frequently failed, ſo as to leave conſiderable gaps, this practice has, of late, been greatly diſuſed. The ſpecies commonly called French furze is the beſt for this purpoſe, becauſe it thickens more near the ground, and grows to a greater height: but it's ſhoots are not tender enough for cattle to eat them. This is alſo deemed the moſt difficult to extirpate: though Mr.

[g] *Gardener's Dict.* Art. Ulex.

Bradley,

Bradley, who tells us [h] that he had ſeen fields of fifty or an hundred acres planted with it in Devonſhire, ſays [i] that it may be killed by cutting the woody ſtalks within a foot of the root in ſummer time; for that it will not then ſpring up again, like the ſmall wild furze, or whins, by which name Mr. Markham diſtinguiſhes the ſmall furze from the larger ſort. This begins to blow in the middle of January, and continues in bloſſom all the ſummer; while the Engliſh furze does not bloom till towards the end of the ſpring, and finiſhes it's bloſſoming at the ſame time as the other.

The Marquis of Turbilly obſerves, that cows, oxen, and moſt other cattle, as well as horſes, feed heartily, upon, and are well fed by, the bruiſed tops of furze; and that one may be ſure corn will do well wherever this plant is met with [k]:—In effect, whatever the ſurface of the ground may be, the ſpontaneous growth of furze always indicates a depth of good mould underneath; and the continual dropping and rotting of the leaves will infallibly improve and enrich that ſurface.

The flowers of the furze are excellent for bees.

Broom (*Geniſta*), if conſidered as a weed, is one of the moſt pernicious plants that grows upon land, becauſe it does not ſhed any leaves, but continually exhauſts the goodneſs of the ſoil. The way to kill it is to pull it up before it ſeeds, to give the ground a ſummer's fallow, to burn-bake, and manure it very well with dung, aſhes, &c. or with chalk, marle, or urine, which is yet more effectual. To deſtroy it on paſture land, the beſt way is to cut it up in May, when it is fulleſt of ſap; becauſe the roots will be killed by that

h *Complete Body of Huſbandry*, *p.* 166. i *Ibid. p.* 177.
k *Mémoire ſur les Défrichemens*, *p.* 258.

means:

means: whereas in pulling it up, part of them are apt to be left behind, and the leaſt bit will produce a new plant. Foddering of cattle upon the land is likewiſe a good way to deſtroy this growth [l], becauſe, beſides their urine, their treading upon it, and upon the ſoil, which is hardened thereby, helps to kill it: for we ſeldom find broom near old roads or path-ways.

Botaniſts diſtinguiſh ſeveral ſpecies of broom, ſome natives of this country, of which the *Geniſta trifolia* of Mr. Ray [m] is our common ſort. It riſes about three feet high, with ſhrubby ſtalks, garniſhed with ſpear-ſhaped leaves, and terminated by looſe ſpikes of yellow flowers, which are ſucceeded by ſhort pods, which turn black when ripe, and contain four or five kidney-ſhaped ſeeds. It flowers in June or July, and the ſeeds ripen in autumn. The branches of this plant are uſed by the dyers, to give a yellow colour; from whence it is called dyer's-broom, green-wood, wood-waxen, or dyer's-weed.

The *Geniſta ſpartium minus Anglicum* of Tournefort [n], ſmall Engliſh broom, called *petty whin*, riſes likewiſe with a ſhrubby ſtalk, but only to the height of about two feet, ſending out many ſlender branches, which are armed with long ſingle ſpikes, and garniſhed with very ſmall ſpear-ſhaped leaves, placed alternate on every ſide of the branches. The flower branches are without ſpines, ſhort, and have five or ſix yellow flowers growing in a cluſter at the end. They come out in April and May, and are ſucceeded by ſhort turgid pods, containing four or five ſmall kidney-ſhaped ſeeds, which ripen in July. This ſort grows naturally upon open heaths, in many parts of England.

[l] MORTIMER's *Art of Huſbandry*, *Vol.* I. *p.* 308.
[m] *Hiſt. Plant. p.* 1723.
[n] *Inſt. R. H.* 645.

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The *Spaniſh broom* (*Geniſta Hiſpanica*) branches more, and grows taller, than either of the foregoing ſorts. It riſes to the height of four feet, with erect ſtalks, wedge-ſhaped leaves ſomewhat broad and roundiſh at the top, but very narrow at their baſe. The flowers of this, which are larger than thoſe of either of the preceeding ſpecies, and of a paler yellow, are produced in pretty long ſpikes at the end of the branches. They appear in June and July, and are ſucceeded by pods like the former ſorts. This broom bears our winters very well in the open field, unleſs the froſts happen to be extremely ſevere.

The twigs of broom, and eſpecially thoſe of the Spaniſh, which are the longeſt, make good baſkets, are uſed for binding, and for making of dry hedges, and are excellent for thatching; being very tough, and of long duration. Ropes alſo, and thoſe not bad ones, for barges and other ſmall craft, are made of the ſtringy fibres of this plant, of which the ancients uſed likewiſe to make a kind of flax[o].

Mr. Bradley has calculated [p], and I believe he is much under the mark, that an acre of broom is worth upwards of ſix pounds, for the feeding of bees only, beſides the wyths and ſtumps, which will pay for the rent of the land. Certain it is, that no flowers are more pleaſing or more profitable to bees, than thoſe of this plant, and eſpecially of the ſpecies called the Spaniſh broom.

Other uſes of broom, which ought not to be omitted here, are, that beſides yielding ſome food to ſheep, in the winter, it then affords them ſhelter againſt the inclemency of that ſeaſon, and the land dunged by them, while they are folded thereon,

o *Maiſon Ruſtiques, Tom.* I. *p.* 888.

p *Compleat Body of Huſbandry, p.* 181.

will

will afterwards bear two good crops of corn. Alſo in countries where there is a great demand for pearl-aſhes, it will be well worth while to plant dry parched ſpots of ground, and ſteep declivities, which will ſcarcely admit of any other improvement, with broom, for the ſake of it's aſhes.

The proceſs by which their alkaline ſalt is obtained, is thus given by Dr. Home, in his very uſeful and accurate experiments on bleaching [q].

"Alkaline ſalt is extracted from the aſhes of all plants, except thoſe which have a pungent taſte and ſmell, as onions, and ſcurvy-graſs; and from all trees, except the moſt reſinous; for theſe afford but a very ſmall quantity of it. The plants or trees, when found, are pulled up, or felled, in the ſpring, and afterwards dried, and burnt to aſhes. By pouring warm water over theſe aſhes, the ſalt in them will be diſſolved; and by ſtraining this water, the ſalt is ſeparated from the earth intermixed therewith. This ſaline liquor, which is called a *lixivium*, is then evaporated over a fire, and what remains is an alkaline ſalt, of the ſame kind as the pearl-aſhes. As ſoon as it is taken from the fire, it muſt be put into veſſels which will preſerve it from the air; becauſe it is ſo attractive of moiſture, that it will run immediately into a liquid, if it has the leaſt communication therewith.

Fern (Filix) is one of the worſt of weeds, and one of the moſt difficult to deſtroy, where it has a deep ſoil to root in. Mr. Mortimer ſays [r] he has ſeen it's roots eight feet deep in ſome grounds: to which he adds, therein agreeing with Mr. Ray [s] and Mr. Liſle [t], that the beſt way of killing it is

[q] Page 148.
[r] *Art of Huſbandry, Vol.* I. *p.* 309.
[s] *Hiſt. Plant. p.* 143.
[t] *Obſervations in Huſbandry, Vol.* II. *p.* 292.

by cutting it often while it is in graſs, and that the three moſt particularly proper ſeaſons for ſo doing are, as directed before in other ſimilar caſes, the ſpring, midſummer, and michaelmas: that is to ſay, when the circulation of the ſap is ſtrongeſt. Moſt of the roots then cut aſunder, and thereby deprived of the channels through which nature intended to convey that ſap, will bleed to death, or, if it ſtagnates in them, will ſoon rot. The fern itſelf, if cut when full of ſap, and left to rot upon the ground, will greatly improve the ſoil, and mellow it ſo as to prevent it's binding: or if it be burnt when ſo cut, it will yield a much greater quantity of ſalt, than any other vegetable. If it is plowed up, plentiful dunging of the land, and ſprinkling it well with aſhes, have been found to kill this weed: but the moſt certain cure for it is urine. In ſeveral parts of the north, where they keep their fern under, and deſtroy a great deal of it by mowing it frequently whilſt green, they alſo find that rolling it is of great ſervice to this end; and when they burn it, the poor make the aſhes up into balls, with a little water, dry them in the ſun, and uſe them in waſhing their linnen, for which they think them nearly as good as ſoap. Often treading down theſe plants, and feeding Scotch ſheep on them, is ſaid to be an almoſt infallible way to kill them.

Trees planted among fern will thrive very much, though it be on a hot gravel; the fern ſhading their roots, and keeping them moiſt and cool.

Fern likewiſe yields a conſiderable quantity of aſhes, fit to make pot, or pearl, aſh.

Wormwood (*Abſinthium*), though a rank weed in paſtures, yields likewiſe a conſiderable quantity of fixed alkaline ſalt; but not at all better than that of any other vegetable, notwithſtanding the great

ſtreſs that is ſeemingly laid upon it in medicinal preſcriptions.

Reeds, ruſhes, flags, and ſuch like aquatics, *arundo*, *juncus*, *gladiolus*, *&c.*) are beſt deſtroyed by draining. If the drains are cut deeper than their roots, their nouriſhment will be taken from them. Aſhes or ſoot will likewiſe kill them; and ſo will plowing of them up, and laying the land in high ridges, to drain it; or mowing of them very early, while the ſap is in them: but if hay is made of this growth, it ſhould not be dried too much; becauſe that will increaſe it's coarſeneſs. Plants of this kind always indicate a good ſoil; for a bad one will not nouriſh them, eſpecially reeds [u], the chief uſe of which is for thatching, and making ſmall fences in gardens.

Worn-out grounds are commonly over-run with moſs (*muſca*): but whatever reſtores the paſture to a good heart, will deſtroy the moſs.

Not to run over here a needleſs enumeration of the names, &c. of the ſeveral weeds which are apt to infeſt paſtures, I ſhall only obſerve once more, in general, that, as in the caſe of arable land, whatever plant grows in theſe, different from what the huſbandman intends to cultivate, is a weed, and ſhould be extirpated as ſuch.

The moſt effectual way of doing this, is to let the graſs remain uncut for a whole ſeaſon, during which the farmer, or a perſon who knows rightly how to diſtinguiſh the plants that ſhould be deſtroyed, ſhould frequently go over the ground, and cut the roots of theſe, under the ſurface, when they are in full ſap, and beginning to bloom. By this means they will be killed before they can ſow themſelves; and the good graſſes, dropping their ſeeds in due time, will ſoon cover the vacant

[u] MORTIMER's *Art of Huſbandry*, *Vol.* I. *p.* 310.

ſpaces

ſpaces. All annual weeds will thus be thoroughly extirpated: and as to the perennial, whoſe roots, which generally run deeper, muſt be killed, as well as their tops, it will be adviſable, whenever they are ſo ſtrongly fixed that they cannot be pulled up by the hand, without farther aſſiſtance, to cut their roots within the earth with a ſpade four or five inches wide, and made with a wing for ſetting a man's foot upon; after which they may be eaſily pulled up, without lifting the turf: or, if the plant ſhould break at the neck, and thereby render it neceſſary to raiſe the turf, in order to get out the root, the turf may be laid down again in it's former place; ſo that the ſward need not be ſpoiled in either caſe. This ſpade may be made ſo light and genteel, that a gentleman may uſe it as a ſtaff when he walks through his fields, and amuſe and exerciſe himſelf very agreeably and profitably by pulling up the weeds as they come in his way; thus freeing himſelf from ſo many robbers, who devour the food, and take up the place, of profitable plants.

This method, though more tedious, is, in the end, better than mowing the weeds; becauſe, as long as any part of them is left above ground, they will be apt to ſhoot out anew; whereas, when they are cut aſunder under ground, their tops will certainly periſh, and their ſucculent roots will rot, and become a manure to the land which they impoveriſhed before.

I muſt here obſerve, that quantities of weeds are frequently introduced into paſture grounds by the ill huſbandry of farmers, who, in hard winters and very dry ſummers, feed their cattle there with foul ſtraw, hay, haulm, vetches, &c. intermixed with the weeds themſelves, or their ſeeds: and the ſame happens to arable land, when it is manured with new dung, or dung not

thoroughly

thoroughly rotted. The ſeeds of weeds in old dung have loſt their vegetative power, and therefore need not be feared.

After the field is cleared of weeds, and the graſs withered, in the autumn, is the proper time to enrich the land with ſuitable manures.

The advantage which plants receive from manure ſpread upon the ſurface of the ground, ariſes from the rich particles of the manure being filtrated, as it were, through the ſurface of the earth, and carried down into it, by rain, or the melting of ſnow: but many of thoſe particles are undoubtedly loſt, and never reach the roots of the plants, in the common way of applying it.

M. de Chateauvieux, ſenſible of this inconvenience, particularly with reſpect to graſs grounds, rightly concluded, that dung, for example, would have a much greater effect, if only juſt the ſurface of the meadow ſhould be cut, and ſome of the internal parts of the earth laid open, ſo that the enriching particles of the dung may more immediately reach the roots of the graſs.

He has ſucceeded admirably in this important improvement, by means of his three coultered plough, which is to be uſed thus. In November, or December, the whole ſurface muſt be cut with that plough, into ſlips three inches wide, which is the diſtance between each of the coulters. This will have two effects: firſt, the coulters will tear up great part of the moſs with which all old paſtures are infected, and gradually deſtroy it: and ſecondly, the coulters, piercing five or ſix inches up into the earth, cut the extremities of many of the roots of the graſs, and thoſe cut or broken roots afterwards produce new ones, which will give freſh ſtrength and vigour to the plants, and, as it were, renew them, and make them young again.

This

This diviſion of the ſurface of the ground, will be very beneficial to the meadows. If the following year proves wet, it will greatly favour the production of new roots.

To render this improvement ſtill more perfect, as ſoon as the whole ſurface of the meadow is cut, dung muſt be carried on it, and ſpread as ſoon after as poſſible. The ſmaller the dung is broken, the more uſeful it will be: becauſe it's minute particles will then be beſt carried by the rain into the traces which the plough has cut, and give ſurpriſing ſtrength to the plants.

This method of repairing and improving poor or worn out meadows and paſture grounds, does not require any great quantity of dung: one load of it will go as far, in this practice, as three would in the common way; and be much more beneficial to the graſs. M. de Chateauvieux has tried it for ſome years, with all the ſucceſs he could deſire. His graſs thus improved, has always been very thick and long, and has yielded him plentiful crops of hay, when fodder has been extremely ſcarce every where elſe. He thinks that one acre thus cultivated, will produce as much graſs as ten in the common way[x].

Another uſe which he makes of the three coultered plough is, to break up graſs lands intended to be converted into arable. The coulters enter five or ſix deep inches into the ground, and cut the turf into parallel ſlips of about three inches breadth, as was ſaid before. Two horſes will be ſufficient to draw this plough, even though it ſhould have five coulters inſtead of three, as it may, for the ſake of greater expedition.

When the whole ſurface is thus cut in ſlips, all in the ſame direction, M. de Chateauvieux plows

[x] DUHAMEL, *Culture des Terres, Tom.* IV. *c.* 3.

the field croſs-wiſe with a common plough, taking only about the breadth of ſix inches at each turn of the plough; by which means thoſe ſlips of graſs are broken into pieces, the largeſt of which are not above ſix inches long and three inches wide.

Theſe plowings ſhould be performed before winter, and in the ſpring. The lumps of turf, expoſed on all ſides to the penetrating froſts of the winter, are either quite mouldered down, or rendered ſo friable thereby, that the field may be plowed afterwards with as much eaſe as if it had been tilled for ſeveral years.

M. de Chateauvieux's deſcription of this plough, is as follows.

"The three coultered plough, *Plate* IV. *Fig.* 2, conſiſts of a beam *A*, *B*, and two handles *C*, *D*, ſupported by the ſtandard *E*. The two ſide pieces *F*, *F*, are faſtened firmly to the beam by two ſtrong iron pins *G*, *G*, on the other end of which a nut is ſcrewed as tight as poſſible. Theſe two ſide pieces, as well as the beam, are pierced with as many mortiſes *H*, *H*, *H*, as it is intended to uſe coulters. The coulters ſhould fit the mortiſes as exactly as can be: and they ſhould be placed at ſuch diſtances from each other, that their points may form parallel lines three inches aſunder, in order to cut the turf into ſlips of that breadth, as at *I*, *I*, *I*.

"1, 2, 3, are three coulters exactly alike, of which the blade *L*, *I*, ſhould be made of tough well hammered ſteel. Only three coulters are repreſented in this figure, in order to render it leſs confuſed: but if it be thought proper to uſe five coulters, by which means the work will be greatly expidited, two additional ones may eaſily be added by making the ſide pieces *F*, *F*, wider in proportion.

"The

"The beam is pierced with the two mortiſes *K*, *K*, in order to faſten it to the fore carriage of a common plough, by running the croſs ſtaves of that carriage, through thoſe mortiſes.

"The coulters are pierced with ſeveral holes, as from *L* to *M*, in order to raiſe them higher, or let them lower down: and they ſhould be of equal length below the beam, that all of them may enter equally deep into the ground. Beſides the pin which faſtens them at top, a wooden pin ſhould be ſtuck into the hole immediately below the beam, to prevent their being raiſed up by their preſſure upon the earth."

M. de Chateauvieux will pardon me, if, as I never ſaw one of theſe ploughs work, I point out what ſeems to me an omiſſion in this. According to the drawing, and to his account of it, too much depends on the ſkill and dexterity of the plowman, to keep the coulters at a proper depth; there being no ſupport at the heel of the plough, to render it more ſteady, and take off the weight, and thereby leſſon the labour of the plowman. I would therefore propoſe that an axle tree ſhould paſs through the beam, as near as may be to the back of the coulters, and that two wheels, proportioned to the length of the coulters, ſhould turn upon this axle tree, at the diſtance of nine inches from each other. This diſtance will be ſufficient to render the plough more ſteady, at the ſame time that thoſe wheels will greatly leſſen the plowman's labour; and as they will run an inch and an half beyond the tracks of the two outward coulters, if there are but three, and an inch and an half within the two outmoſt, in caſe there be five, they will not interfere with the intention of this operation. But if the ſpace of nine inches between the wheels be not enough to keep the plough ſufficiently ſteady whilſt it works, the husbandman

bandman may enlarge that diſtance till it anſwers his intention; provided the wheels be placed ſo as not to run in the channels cut by the coulters.

As the ſtreſs upon the ſide pieces *F F* cannot but be great, and will be very conſiderable if five coulters are uſed; I apprehend it will be right to ſtrengthen them with a thick piece of wood (*N*) laid a-croſs them, underneath, from ſide to ſide, (ſuppoſe at *O*) and ſcrewed firmly to them and to the beam. Holes for the additional coulters may go through this croſs piece, if that ſhould be thought the moſt proper place for them: and if the axles on which the wheels turn when the plough works, are either ſcrewed into the beam, or otherwiſe ſecured ſo that they may be removed at pleaſure; a cheek (*P*), either of iron, or of wood (for there will not be any great ſtreſs upon this part when it is uſed for the purpoſe here intended) may be placed under each end of the croſs bar, and the ends of the axles may be fixed into this, in the ſame manner as they were fixed into the beam. By this means the wheels may eaſily be ſhifted, and the beam will be raiſed ſo high, that the coulters will not touch the ground when this plough is tranſported from one field to another. The coulters may alſo be ſhortened underneath, by pinning them higher up: or the ſledge frequently made uſe of for carrying a plough from one field to another, may be employed here very properly, by laying this plough down ſide-wiſe upon it. Theſe, at preſent, ſeem to me to be the eaſieſt ways of remedying the inconveniencies which a very ingenious, I am ſorry that I muſt add, an anonymous, correſpondent, whoſe letter is ſigned *E F*, has pointed out in this plough, of which he adds that he has ſeen one, though unſkillfully made, and worked with ſome difficulty, uſed to great advantage in this country, both in a graſs ground, and alſo to break

the

the clods and pulverize the earth, before the laſt plowing for corn. — But as I have here reaſoned from ſpeculation only, it would be an acceptable ſervice to the public, if ſome one better ſkilled in mechanics would be ſo kind as to correct my errors. I heartily requeſt it, as a thing which will be very uſeful to the world: and in the mean time I thank *E F* for his very judicious hints, the chief of which has long been an eſſential part of my plan, and will be attended to, ſo far as I may be able, with all the care due to an object of ſuch importance.

When the farmer has cut the whole ſurface of his paſtures with this plough, in the autumn, and manured it properly, he may ſafely promiſe himſelf great crops of graſs.

Ground laid down to paſture may be conſidered, as to it's ſoil, in the ſame manner as arable land has been; excepting only that there is ſome difference in the application of the manure.

All ſtrong ſoils ſhould be improved by plowing before they are laid down to graſs, unleſs they lie ſo flat, and are ſo liable to be overflowed, that there be danger of the whole mould's being carried off, after the ſward is broken up. In this caſe, ſhelly ſea-ſand is peculiarly uſeful; and the more ſhelly it is, the better it will prove, as has been remarkably experienced in Cornwall and in Ireland, in the manner before related[y], as to corn: to which I am now to add, as a proof of it's efficacy in regard to paſtures, that, in Cornwall, after the corn is taken off the ground, a fine white clover, or, if the ſoil be deep, ſome purple, ſprings up; and that this graſs of well ſanded ground, though it be but ſhort, is, for the feeding of cattle, giving good cream, plenty of milk, and

[y] Vol. I. *p.* 20.—28.

all other uſeful purpoſes, far ſuperior to the longer graſs, where leſs ſand has been uſed. Even garden herbs and fruits are greater in quantity, and better in quality, there, than they are elſewhere. It is alſo remarked, that little or no ſnow ever lies in thoſe well ſanded places; that a conſtant winter-ſpring prevails where they are; and that the harveſt there is a month or ſix weeks earlier, than it is at the diſtance of only ſix or ſeven miles from thence [z]. Nearly the ſame has alſo been obſerved of ſmall gritty gravel [a], which has, moreover, been found, alone, to have deſtroyed ruſhes and other aquatic plants, and to have brought up a much finer graſs in their ſtead. Whether this ſucceſs depends on thoſe manures being of a calcarious nature, as hinted before, experiments have not yet determined, that I know of. Dry rubbiſh of houſes, aſhes, and all kinds of vegetable and animal manures, are likewiſe very ſerviceable here.

On wet clayey ſoils, lime is not found to produce effects equal to the expence attending it as a manure: but it is probable, that if the lime ſtones were broken ſmall, and ſpread upon the ſurface of the ground, they would yield a greater and more laſting benefit, than when they are burnt [b]. Unburnt chalk is likewiſe, perhaps, better than burnt.

A compoſt of ſuch ſubſtances as are fitteſt for the above ſoils, and which have been particularly pointed out in the firſt volume of this work [c], may be prepared, or they may be uſed ſingly.

If the ground is apt to be overflowed with a running ſtream, the manure, of what ever kind it be, ſhould be applied at the time when it is leaſt

[z] *Philoſoph. Tranſ. No.* 113.

[a] See *Vol.* I. *p.* 27. [b] See *Vol.* I. *p.* 29, 30.

[c] Part I. *c.* I. §. I. *p.* 19. and §. III. Art. 4. *p.* 110.

liable

liable to this flooding, which would ſeem, generally, to be after the firſt cutting of the hay; otherwiſe, it may be laid on at the uſual time.

Sandy ſoils are improved chiefly by marle[d], which poſſeſſes every quality wanting in the ſand, and, being eaſily diſſolved in water, readily enters into, and enriches the ground. It is therefore, in itſelf, a treaſure, wherever it is found; for it will ſupply the place of almoſt every other manure. Even barren lingy heath ground, in Norfolk, has been made to yield, by the uſe of marle, ſuch crops of clover as were worth double the crops of wheat obtained from an equal ſpace of land in the ſame country[e].

Clay is of too cold a nature for theſe ſoils, unleſs the ſand lie very warm, and be naturally calcarious. In this caſe, indeed, it may be applied as it is taken out of the pit: but otherwiſe, a better way is firſt to burn it.

To this end, dig a quantity of clay, ſuppoſe ſix or eight loads, to begin with, in ſpits about as big as common bricks. The beſt time for doing this is in the ſummer, and in very dry weather; though it may not be improper to have the place where the fire is made, a little out of the ſun, that the ſuperior force of the one may not extinguiſh the other. — After the clay thus dug has been pretty well dried by the ſun and air, make a little pyramid, as if for a bon-fire, of fern, ſtraw, furze, bruſhwood, faggots, billets, coals, or other combuſtibles, and lay around this your pieces of clay, two or three ſpits thick, till the whole pile is incloſed, excepting only a hole in the ſide, to light it at, and another at the top, to make a

d See *Vol.* I. *p.* 37.

e *Philoſ. Tranſ. No.* 37.

draught. When the fire is well kindled, and the ſurrounding clay begins to be thoroughly heated, ſtop up theſe holes with clay, and continue to add all around, as before, more ſpits of this earth, placed in ſuch order that the fire may be pent up within the heap, and never ſuffered to go out: for if that ſhould happen, the work muſt begin again. After that the ſix or eight loads of this ſomewhat dryiſh clay are burnt, the heat within the heap will be ſo intenſe, that even damp clay, brought immediately from the pit, may be laid on without danger of extinguiſhing the fire, if it be not piled up too quick, or in very great quantities. Six or ſeven hundred loads are ſaid to have been ſometimes burnt in one heap, in this manner: but then it has riſen too high to throw the clay up to the top of it, from the level of the ground. A kind of ſtage is therefore built in this caſe, and the ſpits of clay are caſt down from thence. The pile muſt be watched and tended night and day, till it is entirely burnt. The reddeſt and ſtrongeſt clays are reckoned the moſt fertilizing when burnt*, and the common price for

* I will not take upon me to contradict what is here advanced by Mr. Switzer f, in regard to the colour of the clay, becauſe his experience may have proved it to be fact: but an obſervation of Dr. Home's induces me to think, that whatever earth contains iron, which all clays that burn red certainly do, is unfavourable to vegetation.

This accurate obſerver of nature took one pound of good rich mould, and mixed with it one drachm of ſalt of ſteel; then put it into a pot, and ſowed ſome barley in it in the beginning of May. Some of the plants here ſhot up about an inch, looked very ill coloured and ſickly, and then died; while other grains in another pot, filled with the ſame earth, but not mixed like this throve very well g.

f *Method of raiſing Broccli, &c. p.* 36.

g *Principles of Agriculture and Vegetation*, Exp. 16.

I would

for burning them is a halfpenny a buſhel, heaped meaſure. We owe to that excellent patriot, the the Earl of Halifax, this very great improvement in huſbandry, which is now much practiſed in Suſſex, where they allow about ſeven loads to an acre of paſture land.

The Marquis of Turbilly practiſes and recommends [h] ſimiliar methods of burning mole hills and other waſte pieces of pared-off ground, and aſſures us, from his own experience, that the aſhes produced thereby have been of ſignal ſervice to his paſtures, as well as to his arable lands. But he burns that earth ſomewhat more ſlowly, and keeps theſe perpetual furnaces, as he calls them, burning, till the great damps which fall towards the latter end of the autumn put out the fire; for even the heavieſt rains will not extinguiſh it, if the piles are properly formed, and ſo far only attended to, as neither to let them want for ſods or earth to keep up the fire, nor to load them with ſo much at a time, as to extinguiſh it. They are conſtructed in the ſame manner as is here directed for clay, and the aſhes are taken away by degrees, as they are ſufficiently burnt: for too much burning impairs their quality.

Experience has taught what reaſon would ſcarcely have ſuggeſted, namely, that paſtures

I would therefore recommend the clay which burns to the lighteſt colour. — But however the fact may be in this reſpect, the operation of burning clay is certainly expenſive and troubleſome; perhaps ſo far as to deter ſome farmers from practiſing it. To theſe I muſt obſerve, that clay, be it never ſo ſtiff, may be fitted for their uſe, without burning, by mixing with it layers of freſh dung, lime, or any other calcarious ſubſtance, which will ſo far open the body of the clay, as to render it more ſoluble in water, and thereby more eaſily waſhed into the earth by rain. — Perhaps this method of uſing clay may be found more advantageous than burning it.

h *Mémoire ſur les Diſrichemens, p.* 86.

which

which lie on a ſandy botom are greatly benefited by lime: for there are ſeveral inſtances of land which, thus ſituated, and thus treated, has retained a conſtant verdure, and been covered with fine graſs, during ſuch extremely dry weather as would otherwiſe have burnt it up. And another advantage attending this manure, is, that it kills the vermin which feed on, and deſtroy, the roots of the graſs.

Nothing is ſo profitable to marſhy paſtures, as covering them with gravel. If the ſoil is naturally looſe, clay may be mixed with the gravel: but if it be pretty ſtrong, clean gravel is beſt. The earth, by degrees, loſes it's marſhy appearance, and the gravel ſeems to give warmth to the ſoil, ſo that the moiſture evaporates. This is confirmed by the following experiment. A farmer in Swiſſerland [i], made a wooden bridge over a canal, and to render the path to it firmer, he laid a thick coat of gravel a-croſs the meadow, which inclined to a marſhy nature. He afterwards ſaw with ſurpriſe, that the graſs came up in greater plenty, and of a much better kind, than before, ſo far as the gravel extended.

The ſame was alſo remarked, years ago, in Ireland, by Mr. King, who obſerved along the ſides of roads made through bogs, that wherever a little gravel had been accidentally ſcattered upon the bog, it turned thoſe ſpots into a green ſod, covered with a very fine ſcutch graſs: from whence he ſeems rightly to infer, that the ſame charge which ſands or gravels land, will reduce a dried bog, even to be arable [k].

In loamy dry ſoils, lime is a moſt eſſential manure for graſs: but it's effects will probably be

[i] *Mémoires de la Societé Oeconomique de Berne, Tom.* II. *part* I. *p.* 69.

[k] *Phil. Tranſ. No.* 170.

moſt

moſt laſting if the lime ſtone unburnt, and broken very ſmall, is ſtrewed over it. We have a ſtriking inſtance of this in what happened to M. Duhamel, from the chipping of a block of ſtone at his ſeat at Denainvilliers, as related in the firſt volume of this work [1]; where ample directions may likewiſe be found for other manures and compoſts, of which dung is one of the principal, ſuited to this kind of land.

The general manures indicated in the firſt volume of this work, for arable land, will be equally ſerviceable for paſtures: ſuch are, all rotten animal and vegetable ſubſtances, chalk, and, in an eſpecial manner, lime, marle, and aſhes of all kinds.

There are, in this kingdom, vaſt tracts of ground, known by the name of downs, on which are chiefly fed large flocks of ſheep. Experience has abundantly evinced, that though the graſs there is naturally ſhort, it is an excellent food for ſheep; and as the welfare of theſe creatures is of the utmoſt conſequence to one of the moſt eſſential branches of the commerce of England, very great caution ſhould be uſed in making any alteration in their diet, till it be well proved, by fair experiments, that a richer paſture does not injure their fleeces. I would therefore recommend, in the ſtrongeſt manner, to gentlemen who have eſtates bordering on ſuch downs, particularly on that extenſive tract called Saliſbury plain, which reaches from the weſtward of Malborough to the ſea, to bring ſome of their ſheep into rich paſtures, of different graſſes, as well natural as artificial, and to keep them there for ſome generations, in order to aſcertain with certainty, what the effect will be. — The word generations, may, perhaps, here terrify at firſt, as implying a long ſpace of

[1] Page 75.

time

time for theſe experiments, thoſe who do not immediately conſider in how few years this ſucceſſion may take place. — A lamb reared from it's birth on, for inſtance, burnet, will, in two years, bring a lamb, which, in two years more, brings young, and the ſixth year may ſee the third generation: ſo that by the end of ſeven or eight years the fact may be aſcertained.

If ſheep will be equally benefited by richer paſture, then the farther improvement of theſe downs muſt become a matter of great concern, both to individuals and to the public; becauſe, granting that they may be improved with ſafety, the number of our ſheep may be greatly increaſed: but if ſuch improvement ſhall be found in the leaſt detrimental to their wool, inſtead of being encouraged, it ſhould be forbidden, even by law.

Downs, in general, are of a looſe, ſandy, dry ſoil, covered with a very thin coat of mould, in which the graſs grows. In many places, a bed of gravel is ſoon met with, and in others chalk.

Where ſand, or gravel, is the ſoil, the owner of ſuch land generally has in his power an eaſy means of improving it; ſuch ſoils being hardly ever without marle, or a rich earth, underneath them, at a greater or leſs depth. A borer, to find out this earth, and a covering of it when found, are all that is wanted here: but this covering ſhould be frequently repeated, rather than laid on too thick at once. If the earth underneath is of a clayey nature, lime, mixed with it, will add inconceiveably to it's value.

Where the bottom is chalk, with a thin covering of earth, the improvement is more difficult. The aid of the plough will then be requiſite, and part of the chalk muſt be plowed up, to give a greater depth of ſoil. Experiments have ſhewn,

that

that chalk thus looſened will become mould in a few years, by the putrefaction of animal and vegetable ſubſtances growing on, and mixed with it.

The following judicious inſtructions juſt now received in a letter with which I am honoured from the gentleman in Lincolnſhire who was ſo kind as to favour me with his experiments on lucerne, mentioned before, are ſo applicable to the preſent ſubject, by pointing out an excellent means of improving ſhallow ſoils, like thoſe here ſpoken of, that I cannot do better than give them in his own words; after thanking him for this farther proof of his benevolence to mankind, and regretting that, as I feared was the caſe, a former letter of mine did not reach his hands. — They will alſo convey to the public ſome farther obſervations, not generally known, concerning the culture of a valuable graſs.

"Mr. Tull ſays, that a deep ſoil is beſt for "ſainfoin. I believe every thing grow better, in "a better ſoil: but by what I have ſeen of this "plant, I ſhall always prefer for it a ſhallow ſoil, "where there is a rock, or ſome hard ſubſtance, "within ſix inches, or a foot, of the ſurface, to "ſtop the roots of the plants, and make them "ſpread horizontally. This has not only the "good effects propoſed in M. de Chateavieux's "manner of tranſplanting lucerne [m], but, it is "ſaid, occaſions it's filling the ground with more "ſhoots, by their ſtriking up from the knots of "the roots. This fact I cannot verify: but cer-"tain it is, that, in ſuch ſoils as I here ſpeak of, a "crop of ſainfoin which at firſt appears very thin, "will afterwards fill the ground perfectly well, "and the plants of it will appear in much greater "quantities than at firſt.

m See p. 258.

"I

" I have ſeveral times broke off a root of ſain-
" foin four or five inches within ground, and it
" always ſprang up again. This is a ſmall argu-
" ment for the fact I mentioned.

" Sainfoin is much cultivated in Lincolnſhire.
" The common allowance of ſeed is five buſhels
" to an acre. A gentleman ſouth of Lincoln ad-
" viſed me always to ſow a ſmall quantity of tre-
" foil with it (about four pounds on an acre).
" The reaſon is, that, in this expoſed country, the
" young plants ſuffer more by the ſun in ſummer,
" than by the froſts in winter. Now the trefoil,
" coming to perfection the firſt year, and living
" only three, will be a ſhelter for the young plants
" during the firſt year or two, and die off when
" the ſainfoin wants it's room. This ſyſtem is well
" ſupported by practice: but rye graſs ſhould on
" no account be ſowed with it; that being, when
" left for fodder, a great impoveriſher of ground.

" Sainfoin is obſerved to get to perfection in
" three years, laſts good four or five, and then
" dwindles during four or five more. It's firſt crops
" are from one to two loads; it's ſecond ſtage,
" from three to four loads, and it dwindles down
" again to one. — Laſt ſummer, which was re-
" markably dry, did very well with this graſs.

" I have ſown ſainfoin with barley, with wheat,
" without corn in the ſpring, and now" (this gentleman's letter is dated September 4th, 1763) " am ſowing ſome more at this preſent writing; " but can form no judgment as yet.

" Three years ago I drilled ſome, according to
" Mr. Tull's directions, in beds, with treble rows,
" and ſome at equi-diſtant rows. The horſe-hoed
" beds were good, as far as they went: the others,
" drilled at a foot diſtance, gave ſo much room for
" weeds to come up, that the ſucceſs was very
" moderate; which, indeed, would have been the

" caſe

"caſe with the former, had not the horſe-hoe "cleared them. On the whole, as far as my ſmall "experience and obſervations reach, I would never "adviſe any one to drill this ſeed, but to ſow it "in the broad caſt way, on land *very fine*, with a "good quantity of ſeed."

This gentleman is certainly right in ſaying, that there ſhould be no great diſtance between the plants of ſainfoin, if they are not horſe-hoed; becauſe then weeds will riſe up: but in regard to the duration of this plant, the Memoirs of the Berne Society relate [n], that a field of ſainfoin, which was quite worn out, was reſtored by ſpreading it with marle, half an inch thick, and that it doubled it's produce the very next year; which, I am perſuaded, would alſo happen in the above-mentioned caſe.

It is ſo common to find burnet growing naturally upon very dry and ſhallow ſoils, that there ſeems to be great room to think it will anſwer well upon the downs I have been ſpeaking of, if it be cultivated with due care.

The time for for laying manure upon paſture land differs, according to the nature and quality of the manure. Marle and clay ſhould be ſpread upon the ground in the autumn, as ſoon as the after-maſs is eaten off; becauſe they will be mellowed by the winter's froſts, and waſhed in by the rains of that ſeaſon: and the ſame may alſo be ſaid of lime ſtone and chalk. But if theſe laſt are made into lime, the beſt way is to ſpread that lime unſlaked, becauſe it gives an additional warmth to the land while it ſlakes. Where ſand, gravel, rubbiſh of old buildings, or ſuch other ſubſtances as are not diſſolved by the rain, are uſed; they may be carried on at any time during the winter, eſpecially when the ſurface of the earth

[n] *Année* 1762. *Part.* II. *p.* 29.

is

is hardened by froſt, which facilitates their carriage. If animal or vegetable ſubſtances are employed for manure, they ſhould be ſpread immediately, as ſoon as they are carried on; and this ſhould be early enough for them to ſink into, and enrich, the ground before the winter ſets in: otherwiſe, it is beſt to defer uſing them till February, when the ſevere froſts are paſt: for the richneſs of ſuch manures is ſoon, and eaſily, carried off by the heavy rains in the winter.

At all events, whatever manures are uſed, it is neceſſary to roll the ground well in the ſpring, and afterwards to rake away carefully all ſuch fragments and remains of thoſe manures, as the roller has not buried in the earth, ſuch as ſtraws, bits of dung, pieces of lime ſtone, &c. becauſe theſe would otherwiſe obſtruct the growth of the graſs, and render the future fodder diſagreeable to cattle. This rubbiſh has been known ſometimes to amount to almoſt as many loads as were firſt laid on; eſpecially when the dung has not been thoroughly rotted. Careful farmers will therefore let their dung be reduced to a perfect mould before they lay it on their meadows, or, for want of ſuch dung, they will uſe aſhes, pigeons dung, ſoot, lime, chalk, marle, &c.

Thoſe who are beſt skilled in the management of paſtures dreſs their meadows every other, or at leaſt every third year, for otherwiſe no good crops of hay can be expected: but the generality of farmers, following the old method, are ſo much diſtreſſed for dreſſing to ſupply their corn land, that they have not any to ſpare for their graſs. What dung they do uſe for their paſtures, is generally laid them on in the beginning of winter, and ſpread as ſoon after as can conveniently be done, and in this ſituation it remains all the winter. But this is a very ſlovenly way; greatly inferior, in every

every reſpect, to the uſing of dung ſo thoroughly rotted, and reduced to mould, as to be entirely waſhed into the earth by the winter's rains; and vaſtly ſhort of M. de Chateauvieux's method of cutting the ſward in order to let it in.

Beſides two regular weedings every year, *viz.* in April and October, by cutting up the roots of docks, thiſtles, &c. in the manner before directed; particular care ſhould be taken, at all other times, to pluck up every weed as ſoon as it is diſcerned: for ſome of theſe will now and then eſcape the farmer's notice, run to ſeed, and ſow themſelves; and others will ſometimes, in ſpite of his attention, be brought into his lands from the neighbouring grounds. The keeping of his paſtures clear from all ſuch growths will contribute very much to their improvement; as will alſo rolling them with a heavy roller, in ſpring and autumn. This laſt operation will level the ſurface of the ground, ſo that it may be mowed cloſe; and it will help greatly to ſweeten the graſs.

The farmer ſhould likewiſe be careful not to let heavy cattle graze upon his meadows in the winter, if they are apt to be much ſoftened by wet in that ſeaſon. Such lands as theſe ſhould be fed down in the autumn, before great rains come on; and drier paſtures ſhould be uſed, in lieu of theſe, at leaſt till the return of ſpring. If there ſhould not be cattle enough to eat down the graſs in time, it will be better to cut off what is left, than to ſuffer it to rot upon the ground: for this would hinder the young blades from ſhooting up early in the ſpring.

The neceſſity of water, in all paſtures, is ſelf evident; as cattle cannot live without it, and the driving of them far for it is known to be prejudicial to their health, in hot weather, beſides being attended with great trouble, and a conſiderable

loſs of time. This is ſo ſenſibly felt in many parts of England, that people are obliged to dig wells, even to ſuch a depth as, frequently, to require the aſſiſtance of a horſe to draw up the water. The means of rendering it eaſily come at, muſt therefore inhance the value of the land where it can be ſo procured, and are of very eſſential conſequence to the huſbandman.

Where the ſurface of the ground is ſand or gravel, there ſeldom is occaſion to dig deep for water; becauſe ſuch ſoils generally lie upon marle, or ſome other rich earth, through which the water cannot deſcend. Beds of clay are moſt commonly thicker than thoſe of ſand or gravel; and chalk is, too often, the thickeſt of all. But wherever water is wanting, the farmer ſhould bore through the incumbent earth, if he intends to fit his land for paſture: and if he finds the expence of obtaining it too great, his beſt way will be to convert the ground ſo circumſtanced into arable, or to plant it with timber trees ſuited to the nature of the ſoil.

Wherever water ſtagnates in a ſandy or gravelly ſoil, the huſbandman ſees at once at what depth is the ſurface of the earth which retains it. But in other ſoils, and when this does not happen, Palladius [f], and the authors of the *Maiſon ruſtique* [g], give the following directions how to ſeek for water, with the greateſt probability of ſucceſs.

Where ruſhes, reeds, flags, willows, or other aquatic plants grow ſpontaneouſly, or where frogs are obſerved to lie ſquatted down cloſe to the ground, in order to receive it's moiſture, there generally is water underneath. — Perſons who make it their buſineſs to find out ſprings for foun-

[f] *De Re ruſtica, Lib.* IX.

[g] *Tom.* II. *Liv.* 3. *Part* 2. *c.* 5.

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tains, caſcades, &c. look upon it as an infalliable ſign of ſubterranean water, when they ſee a vapour ariſe frequently from the ſame ſpot of ground. — Others aſſure, that wherever ſwarms of little flies are ſeen conſtantly flying in the ſame place, and near to the ground, in the morning, after ſun-riſe, there certainly is water under that ſpot. —— Again, where water is wanted on land apparently dry, let a man, before ſun-riſe, lie down flat upon his belly, reſting his chin upon his fiſt placed cloſe to the ground, that his view may be directed quite horizontally, and not riſe too high, and in that ſituation let him look ſtedfaſtly toward the eaſt. If he then ſees a tremulous vapour ariſe from any particular ſpot, let him mark the place, by noticing ſome neighbouring tree, ſhrub, or other indication, and he will find water underneath it. But this experiment is to be made only on ground whoſe ſurface is dry; becauſe other exhalations, from a damp ſurface, would be apt, in this caſe, to miſlead the enquirer. — Another way is thus. Dig a hole three feet wide, and at leaſt five feet deep, and place at the bottom of it, when the ſun is about to ſet, a pan, or baſon, rubbed with oil on the inſide: let the bottom of this veſſel be uppermoſt; cover it with dry hay, fern, or ruſhes, and over that with earth; and if any drops of water are found ſtanding on it's inſide the next day, a ſpring is probably not far off. — Or, put a new, unbaked, but well dried, earthen veſſel into ſuch a hole, and cover it as before; and if there be water in that place, this veſſel will be found ſoft and wet the next day. — Likewiſe if wool be left all night in a trench of this kind, and water can be ſqueezed out of it the next day, little doubt remains but that plenty of water may be met with there.

The month of Auguſt is generally looked upon as the moſt proper time to ſearch for water: becauſe, I apprehend, as the heat of the preceeding ſummer will have warmed the earth to a conſiderable depth, any ſteam ariſing from water withheld by an impervious ſoil underneath, and particularly in hollows in the ſurface of that impervious ſoil, will then be moſt exhaled by this warmth. Now it is this ſteam, or vapour, which produces the beforementioned ſigns.

By whatever method water is found, the means of coming eaſily at it are the next conſideration. If it be on a plain, there is no other way than digging a well. In doing this, the ſubſtance under the ſand or light ſoil muſt be dug into, to form a reſervoir of water for occaſional wants; and this reſervoir ſhould be made deep and large, in proportion to the quantity wanted. If there were no ſuch reſervoir, the water, after having riſen a little above the impervious body underneath, would glide along it's ſurface, as uſual, and very little of it could then be obtained, either by pumps, buckets, or any other way employed to raiſe it. If the well is made in a ſloping ground, and the declivity is ſufficient to give it an horizontal vent, it will be worth the huſbandman's while to dig ſuch a paſſage, and, by means of pipes, or any other conveyance, to carry the water acroſs the light ſoil, through which it would otherwiſe ſink. The greateſt quantity of water will be obtained in this manner, becauſe there will then be a continual ſtream.

If the ſoil is very deep, and it's ſurface has inequalities in which rain water runs in any quantity; this may be collected in ponds made in the loweſt parts of ſuch grounds.

If a body of clay is found near the ſurface, it is worth the farmer's while to bore, that he may know

know at what depth a bed of ſand or gravel may be met with: for he will be ſure to find plenty of water in this laſt. If this be in a declivity, he need only cut an horizontal paſſage and the water will flow ſo freely as even to double the value of his land.

Here again the farmer needs not ever to be at a loſs, becauſe it cannot be very difficult to make a pond in a clayey ſoil, which is, of itſelf, retentive of water. But it may, perhaps, be adviſable, even in this, to cover the bottom of the pond with a coat of gravel, in order to prevent it's being poached by cattle, whoſe feet would otherwiſe be apt to ſink deep into clay. Some farmers, judiciouſly, pave the declivity by which the cattle enter into the pond, and this renders it much more laſting than it would otherwiſe be.

When ponds are made in a looſe ſoil, much more care is neceſſary. The bottom and ſides there muſt be covered with a thick coat of the toughеſt clay, from a foot to two feet thick, well rammed down. Some have added hair and loam to the outer part of this covering, with a view of rendering it leſs liable to chap: but a thick coat of gravel is more neceſſary here, that the feet of the cattle may not pierce through the clay. — Perhaps the expence of paving the whole inſide of a pond, might, in the end, be money well laid out.

The greateſt difficulty of finding water is in chalky ſoils, becauſe theſe are not, of themſelves, very retentive of it, and generally lie in ſuch thick beds, that it is expenſive to dig through them. However, it ſhould be tried; and if ſand or gravel be found underneath, water may be depended on. Even here, ponds are eaſily made, by digging into the chalk, and lining them with a coat of clay, as before directed. If there is a

ſupply of proper manure, ſuch as clay, or marle, this ſituation is well adapted to grain, which loves to ſtand dry; and as this kind of ground produces more forward crops than clayey or ſtrong ſoils, it may be ſowed early with corn, which will not, in that caſe, be ſo apt to be parched up as graſs is, by the ſummer's drought. If a good ſoil can be made here, a foot deep, it will yield plenty of various ſorts of paſture, either roots or graſſes, as the farmer ſhall judge moſt proper: or it may be planted with different kinds of timber trees, as will be pointed out when I come to treat of foreſt trees.

Water, together with the different particles, which it carries along with it, conſtitutes great part of the nouriſhment of plants. A certain degree of moiſture is neceſſary in order to their living and growing, as appears in our dry paſtures, which conſtantly yield more graſs in wet, than in dry years; and in meadows that are properly watered. Mountainous countries preſerve their verdure better than extenſive vallies, becauſe the loftier part of the air is moiſter, or depoſits more humidity, and fills the hills with more ſprings, which are only the ſurplus of that moiſture, originally diffuſed equally in high ſituations. We are hereby taught, and the precept is verified by the annual overflowings of the Nile, Euphrates, and other rivers, the advantage of watering, and how attentive the farmer ſhould be to the due and rightly timed application thereof. Yet it's uſe is limited: for too much flooding renders the earth marſhy, and fills the graſs with a watery juice, much leſs nouriſhing than when only the proper quantity of water has been let in upon it.

Many owners of paſtures ſituated above the natural level of any adjacent water, have found their account greatly in raiſing it, by the help of engines, to ſuch a height as to be able to overflow them

them eaſily, though at a very conſiderable expence, eſpecially at firſt.

According to the quantity of the water intended to be raiſed, and the height to which it is to be raiſed, different inſtruments are uſed. If it be raiſed but to a ſmall height, a windmill with a ſcoop wheel, as deſcribed in the firſt Volume of this work (*p.* 140. *Pl. II. Fig.* 2.*), may ſuffice; or that with the pump (*Vol. I, Pl. II. Fig.* 4. *p.* 140) may be uſed, if the water is to be raiſed higher.

The oldeſt inſtrument uſed for this purpoſe is known by the name of Archimede's water ſcrew, and is thus deſcribed by Mr. Emerſon [h].

C p D (*Plate IV. Fig.* 3) is a cylinder which turns upon the axis *C D*. About this cylinder there is twiſted a pipe, or rather ſeveral pipes, *no*, *pq*, running ſpiral wiſe from end to end. This cylinder is placed higher at one end, *D*, than at the other; and it's uſe is to ſcrew up the water from the lower end to the higher. *A B* is a river running in the direction *A B*. *a*, *b*, *c*, *d*, are ſeveral floats fixed to the cylinder. *E F* is the ſurface of the water. As the cylinder ſtands in an inclined poſition, the upper floats *a*, *b*, are ſet out of the water, and the under ones *c*, *d* within it: ſo that the water acts only upon the under ones *c*, *d*, and turn about the cylinder in the order *a*, *b*, *c*, *d*. By this motion, the water taken into the ſpiral

* I gladly embrace this opportunity of begging the reader's pardon for the following errors in the lettering of the Figure here referred to, *viz. Fig.* 2. *Pl. II, Vol. I*, and beg he will be ſo kind as to correct them with his pen. Inſtead of *E*, the engraver ſhould have put *C*; inſtead of *L*, he ſhoud have put *E*, inſtead of *S*, he ſhould have put *G*; and inſtead of *R*, he ſhould have put *F*, to make it agree with the printed deſcription (*p.* 140) which was worked off at the preſs ſome time before the engraving of the plate was finiſhed. I confeſs my inadvertence, in not examining it then ſo carefully as I ought to have done.

h *Principles of Mechanics*, *p.* 228.

tubes at the low end is, by the revolution of the cylinder, conveyed through theſe pipes, and diſcharged at the top into the veſſel *G*. If *AB* is a ſtanding water, there is no occaſion for the floats *a b c d*; and then the cylinder is to be turned by the handle at *D*. Inſtead of the pipe, a ſpiral channel may be cut round the cylinder, and covered cloſe with plates of lead. The cloſer theſe ſpiral tubes are, the more water is raiſed: but it requires more force. Alſo the more the cylinder leans, the more water it carries; but to a leſs height.

Where a conſiderable quantity of water is to be raiſed, a greater force is requiſite, than can be applied to ſuch a handle. Her Royal Highneſs the Princeſs Dowager of Wales has cauſed an inſtrument of this kind to be erected at Kew, and by means thereof a ſufficient quantity of water is ſupplied, for all the ponds, and other uſes, in that elegant and extenſive garden: but it is there worked by horſes.

The moſt common engine for raiſing water is the Perſian wheel, of which Mr. Worlidge gives the following deſcription [i].

"This wheel is made much after the manner of "that of an under-ſhot mill, *viz.* with a double "ring, into which are let two pins, on which the "floats are faſtened. Theſe floats are made hollow; "the half that is the moſt remote from the wheel, "holds the water which is taken in at the open "place, above the middle of the back of the "float, and as the wheel goes round, and the "float laden with water riſes, ſo the water, by "degrees, tends towards that part of the float "which is next the wheel, and as the float ſur-

[i] *Syſtema Agriculturæ, p.* 20.

"mounts

" mounts the ciſtern or receiver, the water " empties itſelf into it, every float ſucceeding " the one the other, emptying itſelf into the re- " ceiver: ſo that if one float contain a gallon of " water, and there be 30 floats on the wheel, at " one motion round it delivers 30 gallons of water " into the ciſtern. Such a wheel will be about " 15 foot diameter, the floats at 18 inches di- " ſtance, and will deliver the water at 11 or 12 " foot above the level of your ſtream, and will " go four times round in one minute, and carry " up about 120 hogſheads of water, in an hour, " with 12 or 18 inches penning or ſtopping of " but an ordinary current of water which will " water very well 30 or 40 acres of land: for " if your land be cold and clayey, two much " water does it hurt; and if it be light, warm, " or ſandy, a little water does it much good. It " is alſo to be obſerved, that this motion is con- " ſtant, and will laſt many years without repair, " ſo that it ſtand not ſtill, for one ſide to dry " and wax lighter than the other: alſo obſerve, " that the ſlower it moves, the better it delivers " the water.

" The view of this wheel we have in *Plate IV*, " *Fig.* 4. *aaaa* ſignify the wheel; *b*, the ciſtern " that receives the water; *cc*, the trough ſtand- " ing on treſſels, that conveys the water from " the ciſtern to the place you deſire; *d*, the hatch, " or pen-ſtock that bays up the water to a reaſo- " nable height, under which the water drives the " wheel open; *e* (*Fig.* 5) one of the floats preſent- " ed to your eye, apart from the wheel; *f*, the " place that is to receive the water; *g*, the open " place out of which the water iſſues; *bb*, the two " pins or ledges riveted on to the foreſide of the " float, and wherewith you are to fix the float to " the two rings of the wheel. Theſe, or ſuch like

" wheels,

"wheels, are much uſed in Spain, Italy, and "France, and are eſteemed the moſt eaſy and ad- "vantageous way of raiſing water in great quanti- "ty, to any height within the diameter of the "wheel, where there is any current of water, to "continue it in motion, which a ſmall ſtream will "do.

"How many acres of land lie on the declining "ſides of hills, by the ſides of rivers, in many "places where the water cannot be brought unto "it by any ordinary way? yet by this wheel "placed in the river, may the land be continually "watered, ſo far as is under the level of the water "when raiſed."

Inſtead of raiſing the water by means of the hollow floats placed around the outer circumfe- rence of the rim of the wheel, as here deſcribed; M. Belidor propoſes[k], for wheels of kind, to raiſe it in buckets placed at equal diſtances upon the ſide of the rim of the wheel, and ſuſpended by a pin, upon which they play, as at *A Fig. 6, Plate IV.* When, by the rotation of the wheel, one of theſe buckets comes to *B*, which is the ſummit of the wheel, the upright piece *D*, which is faſtened to the ſide of the trough *C*, turns that bucket upon it's ſide, and thereby makes it empty itſelf into the trough *C*, from whence the water is diſcharged into a receiver at *E*. —— As theſe buckets keep full of water till they are carried up to the top of the wheel, where they are turned over; a much greater quantity of water may undoubtedly, be raiſed by them, than can be by the floats of the Perſian wheel, from which much muſt be ſpilled as it is carrying up. The ſize of theſe buckets ſhould be adapted to the force of the current of the water which they are to take up.

[k] *Architecture Hydraulique, Tom. I. p. 386, Pl. IX. Fig. 3.*

Another

Another excellent wheel for raiſing water, though not to ſo great a height, is repreſented by *Fig. 7, Plate IV.* This engine was firſt invented by M. de la Faye, of the Royal Academy of Sciences at Paris, and is now uſed with great ſucceſs by the honourable Mr. Hamilton, at his ſeat at Pain's hill in Surry, where that gentleman has ſhewn to the world how far a moſt barren ſpot may be rendered uſeful, and an ornament to the country.

This machine conſiſts of a wheel whoſe ſize is ſuited to the height to which it is intended to raiſe the water. This wheel turns upon it's axis *A*, and has four curved pipes *B*, *C*, *D*, *E*, fixed to it, as in the figure. The mouth of the pipe aſcends as the wheel is turned round by the ſtream, in the direction here indicated by an arrow, and the water deſcends from *B* towards *F*, till the wheel has made half a turn, when it is diſcharged into the hollow axle tree *A*, from the opening at the end of which it is conducted by troughs, or other channels, to wherever it is wanted.

Though experience hath long evinced the great advantages ariſing from the overflowing of paſtures, it is but of late years that this very profitable improvement is become pretty general in England; nor is it, as Mr. Worlidge obſerves[1], "yet carried to near the perfection it might be "advanced unto, if the following obſtructions "were removed.

"1. The ſeveral intereſts that are in lands bor-"dering on rivers, hinder very much this im-"provement, becauſe the water cannot be brought "over ſeveral quantities of land ſo circumſtanced, "but through the ground of ignorant and croſs "neighbours, who will not conſent thereunto

1 *Syſtema Agriculturæ, p.* 19.

"(though

" (though for their own advantage alſo) under " unreaſonable terms; and ſome will not at all. " Others, again, are not, by law, capacitated for " ſuch conſent.

" 2. A great and pernicious impediment to " this improvement is the mills that ſtand on " many fruitful ſtreams; prohibiting the laborious " and ingenious huſbandman to receive the bene- " fit and advantage of ſuch ſtreams and rivers, " which carry in their bowels much wealth " into the ocean, while the mills themſelves yield " not a tenth of the profit to the owners, that " they hinder to their neighbours, and their work " may be as well performed by the wind, as by " the water.

" 3. Another grand impediment is the igno- " rance of the countrymen, who are commonly " poſſeſſed with a fooliſh opinion, that the " water leaves all it's fatneſs on the ground it " firſt flows over, and therefore will not benefit " the next; which is moſt untrue; for I have " ſeen meadows ſucceſſively drowned with the " ſame water, to almoſt an equal improvement for " many miles together. It is true, the water leaves " behind it a great part of the fatneſs which it " hath waſhed from the hills and high-ways in " the time of great rains: but we find by daily " experience, that meadows are fertiliſed by over- " flowing, as well in clear and dry weather, as in " rainy, and that to a very conſiderable degree. " The cleareſt and moſt tranſparent ſtreams will " improve even ordinary lands, ſo much as to " render them very fertile meadows.

" 4. From a greedy and covetous principle, " the graſs is ſuffered to ſtand ſo long on the " watered meadows, that it becomes much diſ- " coloured, grows haulmy, and is neither ſo tooth-

" ſome

"ſome nor ſo wholſome, as that of unwatered "meadows.

"5. The former of theſe impediments might "eaſily be removed by a law, which would be of "very great advantage to the kingdom in gene-"ral. The latter can be remedied only by the "example of ſuch induſtrious and worthy per-"ſons as underſtand better things: the generality "of the world being rather introduced to an in-"genious and profitable enterprize by example, "than by precept: although ſome are ſo ſordid "and ſelf-willed, that neither apparent demon-"ſtration, nor any convincing argument whatſo-"ever, can divert them from their bias of ill "huſbandry."

The induſtrious Swiſs, ſenſibly attentive to every means of benefiting their deſervedly cheriſhed country, have thought this branch of huſbandry of ſufficient importance to propoſe it for the firſt premium offered by their truly laudable Society at Berne, for the year 1760: and I gratefully confeſs myſelf indebted to the diſſertations [m] produced thereby, for ſeveral of the following remarks.

Water not only acts as a vehicle to the nouriſhment of plants, but alſo carries with it many particles which enrich the ſoil; eſpecially after heavy rains. It then depoſits a fertiliſing ſediment, which turns the mould to a blackiſh colour. The common ſaying, that *watering makes the ſtones diſappear*, is true; not ſo much from their ſinking into the earth, as from their being covered by the new ſupply of mould brought by the ſlimy muddy water, particularly after great rains. Watering likewiſe promotes the putrefaction of every ve-

[m] *Mémoires de la Societé Oeconomique établie à Berne, Tom.* II. *Part.* I. *p.* 12. *Part.* III. *p.* 483.

getable

getable and animal ſubſtance found in the earth, and thereby contributes greatly to meliorate the ſoil underneath the ſward.

Plants which grow on dry paſtures contain richer and more nouriſhing juices, than thoſe which grow in moiſt places. Care ſhould therefore be taken, that the quantity of moiſture brought upon the paſture, be only ſuch as ſhall give vigour to the plants, without over-charging their veſſels. In order to do this, every part of the paſture ſhould be watered equally, and as little water as poſſible ſhould be ſuffered to go where the land is naturally moiſt.

Extreme heat ſhould alſo be avoided in watering; becauſe heat draws the moiſture too haſtily up into the plant, which is thereby filled with a watery juice, and rendered of ſo tender a texture, as eaſily to be killed afterwards by drought or cold.

If the ſpring proves dry, paſtures may be watered as ſoon as the froſty ſeaſon is over; and this may be continued till the graſs begins to ſhoot. But if the winter has been ſevere, and the earth remains moiſt, no current of water ſhould be admitted, till the earth looſened by the froſt is ſettled, and the ſurface become pretty dry: for even the gentleſt ſtream would carry off the fine mould looſened by the froſt. After that the graſs has begun to ſhoot, and the weather is become mild, the water ſhould be adminiſtered more ſparingly; that is to ſay, in ſuch proportion only, as juſt to puſh the graſs gently on, till it has made ſuch a covering as can ſhelter the earth from the two great power of drying winds, or of a ſcorching ſun. Watering ſhould afterwards be uſed with great caution, and only in caſe of extreme drought; nor even then, unleſs the water be perfectly clear and ſweet, leſt it ſhould foul the graſs, or give it

a bad

a bad taſte. If it be admitted ſparingly before the hay is cut, it will make the graſs ſtand the better to the ſcythe.

For a little time after the hay is made, the water ſhould be admitted only in the night; becauſe the weather then generally is very warm: for it is obſerved, that rain which falls with a hot ſun, or a hot ſun that comes on a heavy dew, is prejudicial to plants. Watering, under the ſame circumſtances, will have the ſame effect: to prevent which, the prudent husbandman will let in his water only in the evening, and will withdraw it again before the ſun gets up. It is continued at this ſeaſon only till the graſs begins to ſhoot vigorouſly; and in caſe of very great drought it may be repeated, but very ſparingly.

If a ſecond crop of hay is made, the water may be uſed more freely; as the weather is then become cooler, and the earth is generally very dry. This flooding will bring up a plentiful after-maſs. If the ſecond crop of graſs is fed off, the watering ſhould be renewed in the ſame manner: only care ſhould be taken not to ſuffer cattle to feed on the ground while the water is upon it, becauſe their poaching would deſtroy the roots of much of the graſs, and leave the ſurface uneven; which ſhould be avoided in a paſture.

The latter end of autumn is the ſeaſon in which watering is the longeſt continued: and conſidering the dryneſs and parched ſtate of the earth at that time, this practice ſeems rational: for the water then, not only ſupplies the moiſture wanted in the earth, but it diſſolves every ſubſtance ſoluble in water, and thereby converts to an additional manure, what might otherwiſe have remained long in it's original ſtate. Care ſhould, however, be taken, to drain off the water before the ſeaſon of ſtrong froſts is expected; becauſe froſt is obſerved

ſerved to deſtroy all kinds of vegetables much more when the plants are full of ſap, than when they are in a dryer ſtate. We may eaſily comprehend that it muſt have this effect, when we conſider with what force it breaks every veſſel containing water expoſed ſo as to be frozen: for froſt dilates all fluids to ſuch a degree, that the veſſels in which they are muſt be broken thereby. Hence it is that ſucculent plants ſoon become a putrid maſs after a hard froſt: and thus it is that the ſtrongeſt trees are ſometimes burſt with a loud report.

When the water is brought to the deſired height, the main channel ſhould be cut, with ſuch a deſcent as only juſt to keep the water in a gentle motion. That channel ſhould be made in the higheſt part of the paſture, and proportioned to the quantity of water neceſſary to be introduced. If a hollow intervenes between the place at which the water is brought into the field, and another riſing ground in that field; it will be worth the farmer's while to convey it a-croſs that hollow, by pipes made of wood, or any other ſubſtance, laid either horizontally over that hollow, or underneath it. The motion of the water in this horizontal channel ſhould be different, according to the quality of the ground. If it is a ſtrong earth, the channel may be cut nearly horizontally: but if it is a light looſe ſoil, a quicker current ſhould be given to the water, in proportion to the degree of lightneſs of the earth; or great part of the water will otherwiſe be loſt, by ſinking into it. In a light ſoil of this kind, it may be proper to line this main channel with brick or ſtone, well cemented with lime, to hinder the water from eſcaping through the crevices; or at leaſt to cover it with clay well rammed. As to the degree of deſcent moſt proper for the main channel, in order

to

to give a current to the water. M. Bertrand, to whom we owe one of the ingenious diſſertations on this ſubject in the Memoirs of the Berne Society, obſerves[n], that Vitruvius required ſix inches in an hundred feet, which is a great deal too much: but that the moderns, who have made the moſt exact experiments in this reſpect, are ſatisfied with two inches in ſix hundred feet, when they cannot have more, and recommend particularly the avoiding of all ſharp angles in the winding of the channel, and the making of it's bottom quite ſmooth and even. He adds, that this is nearly the declivity of the aqueduct of Rocquancourt, by which the water is conveyed to Verſailles; the diſtance there being three thouſand four hundred yards, and the ſlope, in all, only three feet.

The main channel ſhould be of breadth, rather than depth, ſufficient to receive all the water that is intended to be conveyed through it, and that breadth ſhould leſſen gradually as the water is carried off in leſſer channels, in order that the water may preſs into thoſe ſmaller ducts, which are to iſſue all along from the chief. The leſſer channels ſhould be as ſhallow, and as numerous, as can be: for the more equally the water is diſtributed over the graſs, the greater will be the improvement. They ſhould be made particularly wherever the water collects itſelf into a ſtream: for though cutting ſo much turf may ſeem to waſte a great deal of land, yet it proves not ſo in the end; becauſe the quicker the water runs over the graſs, the more it benefits the paſture.

To keep the channels in repair, they ſhould be frequently cleaned, eſpecially after every cutting of the hay. The ſlime then taken out of them

n *Tom.* II. *Part.* III. *p.* 90.

ſhould be ſpread upon the paſture, and the next growth of the graſs will be greatly improved thereby. Care ſhould alſo be taken to have drains to carry off the water, ſo that none of it may ſtagnate upon the land.

The beſt way of watering a flat meadow, which is uſually ſurrounded with a ditch, is to ſtop the out-let of the ditch, and, by bringing in a quantity of water, to overflow the whole meadow, for ſuch time as ſhall be judged neceſſary to moiſten the earth ſufficiently: but the water ſhould not be continued upon it ſo long as to wither the graſs. If this can be done in a rainy ſeaſon, it will be ſo much the better; becauſe the water will then be loaded with the enriching mud and ſlime waſhed down from the higher grounds.

The firſt heavy rains which fall in the latter end of the autumn, and which carry with them the rich particles of putrefied animals and plants, are thought to be more fertilizing than at any other ſeaſon of the year, and are therefore brought into the paſture, as often as the abſence of the cattle fed on them will permit.

The next beſt to rain, is clear and ſweet ſpring water, flowing from a copious ſource. Here it is generally objected, that ſpring water is hard, and therefore not fit for the nouriſhment of plants. But Dr. Home, who judges otherwiſe, expreſſes himſelf thus on this very occaſion°. "Is not hard "water more nouriſhing for vegetables than ſoft "water? I imagine that the ſalt of vegetables "enters their veſſels in ſuch a form as hath the "ſalt which is found in hard waters. The ſalt of "hard waters ſeems likewiſe to be of the nitrous "kind, of which the nouriſhment of plants is alſo "ſuppoſed to be — This query thwarts the gene-

° *Experiments on Bleaching*, p. 300.

"ral

"ral opinion: for no gardener will make uſe of "hard water, if he can avoid it.— I watered ſome "plants with it, and thought that they grew "better than thoſe which were watered with ſoft "water."

This is confirmed by an ingenious correſpondent of the Berne Society [p], who made ſeveral experiments on the qualities of different waters, and found that their greater or leſs hardneſs made very little difference in their effects, when uſed for watering of paſtures. The water of an excellent ſpring, which, upon trial, was found to be hard, fertilized greatly the paſture upon which it was let in.

Spring water may be uſed later in the winter, than any other, becauſe, being warm, a mild froſt will not freeze it, even when expanded on the paſture. It ſhould however be turned off ſoon enough to let the earth become a little dry before ſevere froſts ſet in. It may likewiſe be uſed earlier in the ſpring, than other waters, and to better advantage, by reaſon of the warmth which it communicates to the ground where it flows: and it becomes extremely proper in the ſummer, becauſe it cools during the night (the only time for watering at that ſeaſon) the heated ſoil, and graſs ſcorched by the power of the ſun.

The equal warmth of ſpring water, is what renders it peculiarly uſeful for watering paſtures. The laſt quoted correſpondent of the Berne Society tried it's heat, in Swiſſerland [q], on the 26th of May, when the earth had been very little warmed by the ſun, after a long winter's cold. He then found M. de Réaumur's thermometer, placed in the ſpring of water, ſtand at 8½ degrees (equal

[p] *Mémoires pour l'année* 1761, *Tom.* II. *Part.* I. *p.* 97.

[q] *Ibid. p.* 100.

to 47½ of Farenheit's) above the freezing point. On the 5th of July, in the evening, when the heat of the air was very great, Réaumur's thermometer, again placed in the ſpring, ſtood at 9½ degrees (equal to 49 of Farenheit). He afterwards tried whether the warmth of the ſpring was conſiderably increaſed towards the end of the ſummer, when the earth was extremely heated: but even then, Réaumur's thermometer ſcarcely reached 10 degrees (equal to about 50 of Farenheit's). By this we ſee, that ſprings which yield a full and conſtant ſtream vary very little in their degrees of warmth.

For the ſame reaſon it alſo is, that a perpetual verdure reigns around ſuch ſprings, even during the hardeſt froſt; and if their water could be preſerved from freezing when ſpread over a field during the winter, it would be right to let them in upon paſtures in that ſeaſon: but as they ſoon loſe their heat when diſperſed over the graſs, this is by no means adviſable.

Experience has taught the inhabitants of the Alps (and the ſame will hold equally true in all mountainous countries), that it is not adviſable to water paſtures with the floods which ariſe from melted ſnow, or with the water of rivers fed thereby.—One reaſon which ſeems to render the water that deſcends from mountains perpetually covered with ſnow the leſs uſeful for watering paſtures, is, that as all vegetation is at a ſtand in ſuch places, no vegetable matter can be mixed with this water; and it therefore cannot communicate the fertility which ariſes from waters fraught with thoſe rich ſubſtances.

We are frequently told of correcting the crudity of water, by making it turn a wheel, or putting it otherwiſe into violent motion: but I know not what good effect this can have.

What

What are commonly called barren ſprings, are ſometimes corrected by mixing dung with their water in ponds made higher than the paſture intended to be watered. Yet this, though an old cuſtom, is liable to ſome objections; one of which, in particular, is, that the water will depoſit it's richneſs on the firſt part of the paſture over which it flows, and therefore improve the graſs very unequally. But if dung has this effect, it will anſwer equally well, if it be ſpread upon the land. Care ſhould, indeed, be taken, that the current of the water be very ſlow over a paſture newly dunged; becauſe the fertilizing particles of the dung may otherwiſe be carried off by the ſtream, before they can have had time to penetrate into the earth.

When dung, marle, or lime, is laid on a paſture which has a conſiderable deſcent, the beſt way is to lay a larger proportion on the higher parts; becauſe the common rain water will waſh ſome of their richer particles down to the lower.

As clayey ſoils retain water, and by that means chill the plants growing on them, they are the leaſt fit for watering of any. If the water abides on them, they become poachy; and when dried again, they gape, and become ſo hard that no plant can pierce them. Some ſenſible farmers have likewiſe obſerved [r], that their clayey lands have always yielded leſs graſs in wet years, than when the ſeaſon has been dry; which is a manifeſt proof that a ſoil of this kind does not admit of watering, unleſs it be a little, in caſe it's ſurface is become hard after the hay has been taken off, or when the graſs is ſhort. Such lands are fitter for arable, if their ſituation permits it.

[r] *Mémoires de la Societé Oeconomique de Bern, Tom.* II. *Part* I. *p.* 70.

Hazel earth, which is a loam mixed with gravel, and of a clayey nature, is the ſtrongeſt ſoil that can be watered with propriety: and that this has been ſurprizingly benefited thereby, is evident from ſeveral inſtances given in the Memoirs of the Berne Society, even of large tracts of ſuch ground that have been vaſtly improved by this means: but I ſhall mention here only the following.

" In the ſummer of 1758[s], part of the paſture ground belonging to a farmer in Swiſſerland was ſo entirely covered with ſtones and gravel, by the ſudden overflowing of a ſtream, that it looked like a bank of ſand. As the removing of this quantity of ſtones and gravel would have coſt a great deal of labour and expence, the owner of the land carried off only the largeſt ſtones, and threw over the gravel a reddiſh earth taken from a neighbouring hill; but ſo thinly ſpread, as only to fill the interſtices between the pebbles, without entirely covering them. He then ſowed this ſpot with hay ſeeds, and let in upon it the waters of an adjacent ſpring and a neighbouring rivulet. Theſe waters were let in ſparingly at firſt, till the graſs began to appear, and after that they were flowed more abundantly. The conſequence of this prudent conduct was, that the graſs thus raiſed bore cutting once the firſt year, and after having been mowed twice in the ſecond, promiſed an excellent after-maſs at the time when this account was written, which was in the beginning of the autumn of that ſecond year. The very firſt year's crop grew ſo prodigiouſly, that the graſs was lodged, even though the pebbles were then felt under foot, if one trod upon it."

Black rich mould requires but a moderate quantity of water: juſt ſufficient to give action to the fertilizing particles which it contains. The

[s] *Id. p.* 76.

watering

watering here ſhould be frequently repeated, rather than long continued.

It is a general rule, that ſandy or gravelly ſoils require watering the moſt of any; becauſe whatever moiſture they receive, ſinks through them too ſpeedily. But it may be doubted, whether this very reaſon for watering them, be not one of the greateſt of objections againſt their being watered, at leaſt ſo much as is generally directed: for the water not only paſſes rapidly through theſe ſoils, but it may carry down with it through the ſand or gravel, the finer and richer particles of the ſhallow mould uſually found upon ſuch ſoils, and thereby rather impoveriſh their ſurface. It would therefore ſeem adviſable, to let water in upon ſuch ſoils only occaſionally, to refreſh their verdure, when their ſurface is too dry: and to give it a pretty quick current, that it may reach to a greater extent of ſurface: for if it runs ſlow, it ſinks too faſt.

It is a queſtion whether paſtures newly laid down to graſs, after having been arable land, ought to be watered at all during the firſt year. The judicious author of one of the ingenious diſſertations before referred to in the Memoirs of the Berne Society, conſulted on this ſubject an intelligent farmer, who had experienced the effects of watering, and of not watering, theſe *new* paſtures, as ſome call them, and was anſwered[t]; that they had yielded the greateſt quantity of graſs the firſt year, when they had been watered, but that the crops had always dwindled in the ſucceeding years: whereas thoſe that were left dry till autumn, and then only begun to be watered, had made ample amends during the following years, for the ſcantineſs of their produce in the firſt. This husbandman was therefore of opinion, that it is beſt not to water theſe meadows before

[t] *Ibid. p.* 85.

the autumn; and he added a farther very ſenſible reaſon, namely, that as theſe new meadows ſtill retain ſome portion of the manure laid upon the land the year before, when it was ſowed with corn; the letting in of water upon them, while the mould is yet extremely looſe and light, will be apt to carry off thoſe rich remains of manure, which will otherwiſe incorporate with the ſoil, as it acquires more conſiſtence.

A very wrong cuſtom which prevails among our farmers in general, with reſpect to low meadows, is, that of flowing them during the whole winter. The roots of all the ſweeteſt kinds of graſſes are thereby deſtroyed, and only ſuch left as are natives of marſhes, which are coarſe and ſour, and which no cattle will eat.

The method which Mr. Miller propoſes [u] for the management of theſe meadows, is never to flow them till the middle or latter end of March, excepting once or twice in the winter, when ſuch floods happen, as bring down a great deal of ſoil from the upper lands: for then it will be of great ſervice to let ſuch water in upon the meadows, that the ſoil may ſettle there: but the ſooner the wet is drained off after this is lodged, the greater will be the benefit done to the meadows. By letting on the water frequently, from the end of March to the middle of May, the growth of the graſs will be greatly aſſiſted, and there will not then be any danger of deſtroying it's roots.

River water, which is univerſally acknowledged to be the beſt for this purpoſe, cannot be ſo beneficial when the ſtream overflows it's banks, and runs rapidly over the paſtures, as when it's courſe is ſlow; and ſtill much leſs than when it ſtagnates. It therefore is adviſable to fence in every meadow

[u] *Gardener's Dict.* Art. MEADOWS.

liable

liable to be thus overflowed, in ſuch manner that it cannot be flooded, but at the owner's pleaſure, by opening proper ſluices. But as the produce of many meadows will not bear this expence, the proprietor, or farmer, ſhould, if poſſible, prevent the too haſty current of the water, by raiſing at their upper end, or wherever elſe it may be neceſſary, ſuch fences as ſhall render the water which flows ſidewiſe upon the meadow, rather a back, or ſtanding water. Great advantages will ariſe therefrom. The finer mould will no longer be carried away by the ſtrong current of the river, which, inſtead of robbing the ſoil, will then depoſit a rich ſediment, and thereby greatly fertilize the land.

The water of mineral ſprings ſhould not by any means be brought upon paſtures; becauſe they are either deſtructive of graſs, or produce only a very harſh coarſe kind of it.

I ſhall cloſe this ſubject with the following remarks made by the judicious author of one of the before mentioned diſſertations in the Memoirs of Berne the Society [x], and which deſerve the ſerious attention of every huſbandman who would water his paſtures with due care.

"Many people imagine, that the whole art of "watering meadows conſiſts in making good "channels, and in opening and ſhutting the "ſluices at proper times. But this is not enough: "for ſo long as the water flows in a meadow, the "farmer ſhould viſit all his channels once or twice "a day, with a ſhovel, hoe, or three-grained "fork in his hand, and examine carefully whe-"ther any of them want cleanſing or repairing. "Sometimes he will find a channel choaked with "ſlime; in other places he will ſee the water

x *Tom* II. *Part.* I. *p.* 216.

"ſpread

" ſpread too far, or not far enough; and in " others again he will obſerve it not riſe high " enough to overflow it's channel, ſo that the " neighbouring ground is not watered at all. He " will immediately endeavour to remedy theſe " defects, according to the exigency of the caſe, " whether by clearing away the muddy ſlime, " heightening the banks of the channel, lowering " them, giving a freer current to the water in " ſome places, and checking it's courſe in others, " according to the nature of the ſoil; or, by cutting " new channels in ſome places, and laying ſods or " ſluices acroſs others, to divert the ſtream from " ſuch parts as are ſufficiently moiſt, and turn it " to others which want watering: for it frequent- " ly happens that, even in the ſame meadow, " though not a large one, there are very different " ſoils, each of which requires the aſſiſtance of " of water, but in different degrees. In ſhort, the " careful husbandman will not ever viſit his " paſtures, without noticing in them things which " may be altered and amended."

The farmer who has improved his paſtures according to the foregoing directions, may expect abundant recompence in plentiful crops of graſs. But ſome farther ſkill is yet neceſſary in the management of that graſs, in order to have it in the greateſt perfection.

When graſs is to be fed off, it ſhould not be permitted to ſtand till it grows high, becauſe the cattle will then trample under foot great part of it, which they afterwards will not eat. The prudent husbandman will alſo vary the kinds of cattle fed upon it, according to the principles before laid down.

When the graſs is to be made into hay, the farmer will be directed in the ſeaſon of mowing it, by the quality of the graſs. When the crop is very

very great, it ſhould be cut as ſoon as the bottom of the graſs grows yellow: for if it ſtands longer, more will be loſt by the quantity of leaves rotted at the bottom, and the ill flavour which theſe will give to the reſt, than will be gained by it's growth. When other circumſtances permit the choice of time, it ſhould be when the graſs is in full bloom, before the ſtalks begin to harden, and rather early than late; becauſe the more ſap remains in the roots, the ſooner the next crop will ſpring up. There is not, however, any general rule for this; becauſe, in ſome caſes, the ripe ſeeds add a great value to the hay, as in ſainfoin and burnet; and in others, the growth of the graſs itſelf brings a recompenſe, as in the fowl-meadow graſs.

A dewy or dusky morning ſhould be choſen for cutting the graſs; becauſe, being then fulleſt of ſap, it ſtands beſt to the ſcythe. When the high noon-tide ſun has dried the graſs, and made it recline it's head, the mower will employ his time more uſefully in making the hay already cut, than in continuing to mow, with great additional labour, graſs which no longer makes the due reſiſtance,

Our farmers in general are very inattentive to the management of their hay whilſt in the cock; to which is in a great meaſure owing the loſs which they (or rather the nation) ſuſtain every year, by the damage which the hay receives from rain.

To guard as much as poſſible againſt this accident, let the hay-makers follow the mowers, and, if the weather be quite fine, ſpread out the graſs as faſt as it is cut down, eſpecially if it lie ſo thick in the ſwarth, that neither the air nor ſun can paſs freely through it: but if wet be feared, let it remain in the ſwarth. At night, make it into graſs cocks, and the next day, as ſoon as the dew is off

the

the ground, ſpread it again, and turn it, that it may wither on the other ſide; then handle it, and if you find it dry, make it up into large cocks. If the weather continue favourable during the ſecond day, the graſs will, by that time, be ſo dry as to bear being kept in theſe cocks till the day on which it is to be carted, when it ſhould be ſpread out again in the morning, to receive a farther drying, if wanted. If theſe cocks are made as tall and as taper as can be, conſiſtent with their ſtanding ſafely, the winds, by paſſing through them, will dry them gently and equally; and though rain ſhould fall upon them, it will not do much hurt, becauſe the greateſt part of it will run off directly, and the ſun and wind will ſoon dry that which may have penetrated into the cocks. Theſe cocks have therefore a great advantage over the common ſmall and low ones: for if a rainy ſeaſon comes on, theſe laſt will be ſo thoroughly wetted, that the wind will not be able to pierce ſufficiently to dry them. More hay is, perhaps, loſt for want of making the cocks properly, than by all the rains which happen in the hay-making ſeaſon.

The method here recommended is confirmed by the experience of a New England husbandman, whoſe account of it to the reverend Dr. Eliot runs thus [y].

"I ſhall relate to you my own practice in mak-
"ing of hay, though it may ſeem ſmall and tri-
"fling at the firſt mentioning: but finding that
"it ſaves me near two fifths of the time and la-
"bour I uſed to be at in this article, and that
"my hay is, I think, better than when I uſed to
"purſue the uſual method, I eſteem myſelf juſtified
"in communicating it to the public. My method
"is this. I mow my graſs, and let it lie in the

[y] *Eſſays upon Field-Husbandry in New England, p.* 70.

"ſwarth

" ſwarth till the dew is off the next morning: then
" I turn and ſpread my hay, and let it lie in the
" ſun till the after part of the day, when I take it
" up and cock it well, and never meddle more
" with it, till I cart it into my barn, or ſtack it.
" If the weather be good, it will do well to cart
" after it has ſtood two days in the cock. This, I
" have found by five or ſix years conſtant expe-
" rience, anſwers for any ſort of hay, except ſalt-
" hay and red clover, of which laſt I have not
" had ſo long trial: but with reſpect to clover hay,
" I managed it laſt ſummer after this manner,
" *viz.* I followed my mowers, as they cut the
" graſs I ſpread it as thin as I could, and before
" night I put it in cock. The next day, after the
" dew was off, I ſpread it again; in the after-
" noon, I cocked it a ſecond time, and meddled
" no more with it till I carried it. The appear-
" ance of the hay ſince, makes me judge that no
" man has better of the ſort. My firſt coming
" into this practce was purely accidental. After
" cutting my graſs, five or ſix years ago, I put it
" in cock the next day; but my avocations then
" were ſuch, that I had no time in which I could
" poſſibly take any farther care of my hay for
" many days. When I had diſpatched my other
" affairs, I returned to it, and found it in as good
" order (that is to ſay the bulk of it) as ever I
" had hay in my life. Reflecting then, how much
" labour may be ſaved by this method, I have
" followed the ſame practice ever ſince, and find
" it anſwer very well. The reaſon why I think
" my hay really better is, becauſe I take it for
" granted, that the more juice or natural moiſture
" we can retain in it, without corrupting and
" rotting the ſtalk, the richer and more nouriſh-
" ing it is. The too often turning and ſpreading

" of

"of hay in the ſun extracts too much of the "richneſs thereof, and one day's thus lying will "take away ſuch a quantity of the moſt watery "particles, as that the remainder is only ſufficient "to raiſe a proper fermentation thereof when in "the cock, while the ſmallneſs of the body there "keeps that fermentation from riſing to ſuch a "height as to corrupt it. After twenty four hours, "the fermentation will gradually abate; and the "pitching of the hay into the cart, and afterwards "into the mow, or ſtack, ſo checks it, that it will "not again riſe to ſuch an height as to be de-"trimental. Cattle are fonder of this hay, than "of that which is made in the common way, and "leſs of it will ſupport them."

It would be almoſt needleſs to obſerve, that no narrow wheels ſhould ever be brought upon paſtures, not even in the drieſt ſeaſon of the year, as that of hay-making generally is. The advantages of broad wheels, which help to roll and level the ground, and render the draught much eaſier, whether on graſs, or any other ſoil in which narrow wheels will ſink, have been confirmed by experience; and are as ſelf evident, as it is that the latter cruſh and bury, and thereby deſtroy great numbers of the plants of graſs, wherever they are dragged.

If the hay has ſweated a little in the cock, there will be the leſs need for it's ſweating afterwards in the rick, where it will then lie ſo much the cloſer, and conſequently keep the better.

SALT MARSHES are generally very rich land; but they moſt commonly lie ſo flat, that it is neceſſary for the owner to keep all the water he can from them. The ſea water, in particular, ſhould be fenced off as much as poſſible; and this is uſually done at a very great expence, by high banks,

banks, walls, and ſluices, as deſcribed in the firſt volume of this work[z].

The two things chiefly wanting in theſe lands are, good ſhelter for the cattle, and freſh water; both of which the induſtrious farmer may obtain, at leaſt in a great meaſure, by digging, in proper places, large ponds to receive the rain water, and by planting trees and hedges towards the ſea, where they will not only afford ſhelter to the cattle, but keep off the ſharp winds which often cut away the tops of all the graſs, and leave the ground as bare as if it had been mowed. It would likewiſe be of great ſervice to divide the marſh into different incloſures, by making banks covered with hedges, and ſuch trees as delight in a moiſt ſoil; for theſe will add much to the warmth, and become very profitable by their cuttings. Theſe lands fattten all ſorts of cattle the ſooneſt of any, and preſerve ſheep moſt effectually from the rot.——Of this, I have juſt received an indiſputable atteſtation, in the following paragraph of a letter from my worthy correſpondent in Lincolnſhire.

"In the marſhes in this county (Lincolnſhire), "which were recovered from the ſea, ſheep never "rot: nay, if a ſheep is tainted, and ſent to the "marſhes, the rot will proceed no farther. This "is attributed to the ſalt; and I have heard of a "farmer who drove his ſheep into the ſea, and "made them ſwallow ſea water, which had the "ſame effect.

"I will juſt mention," continues the ſame generous friend to mankind, "a receipt to prevent, "or ſtop, the rot, where neither ſalt marſhes, nor "ſea water, can be come at.

See *p.* 143.—148.

"Steep

" Steep a handful of rue in a pail of water all " night, and at morning put in as much ſalt as " will make it bear an egg. Give each ſheep half " a pint of this liquor, and repeat it thrice, every " other morning.

" A farmer who kept four hundred ſheep tried " this receipt in the laſt general rot (about five " years ago), and did not looſe any, though his " neighbours loſt almoſt all theirs. For the ſake " of the experiment, he ſet apart about twenty, " and did not give them this drink. — Many of " theſe were rotten."

When the farmer is obliged to feed his cattle with ſuch coarſe hay as they are not fond of, he will do well to mix ſalt with it, in the proportion of two pounds to an hundred weight, as adviſed in a memoir preſented to the Berne Society [a]. This will quicken their appetite, and may be a means of preſerving their health.

The American *black graſs*, as it is called, and of which the reverend Dr. Eliot was ſo kind as to ſend me the following account, ſome time ago, would probably be a vaſt improvement to our ſalt marſhes, in which we have not, ſo far as I have been able to learn after repeated inquiries, either that ſort, or any other that promiſes to be equally beneficial. It would therefore be well worth the while of thoſe who are poſſeſſed of ſuch marſhes, to procure ſeeds of it from New England, from whence our excellent Society for the Encouragement of Arts, &c. has commiſſioned, but not yet receiced, a quantity of them.

" We have," ſays that late moſt reſpectable clergyman, in one of the letters with which he was pleaſed to honour me, " an excellent ſort of " graſs in our ſalt marſhes. It thrives beſt, and

a *Memoirs et Obſervations pour l' année*, 1762, *Part.* I. *p.* 103.

" grows

" grows largeſt, in thoſe meadows which border " on tide rivers, and have the greateſt mixture of " freſh water. Where the water is very ſalt, it is " not apt to fix and ſpread; but will remain ſhort " and poor. It is very tender, and cuts as eaſily " as garden cives, grows thicker and taller than " the common ſalt marſh graſs, and affords from " two to three tons of hay to the acre: but " but it is a ſlow grower, after it has been cut. " It's ſeeds are ſmall; like thoſe of tobacco. The " colour of this graſs is a very deep green, which " renders it ſo conſpicuouſly different from every " other kind, that it is univerſally known by the " name of *black graſs*.

" This ſpecies introduced itſelf long ſince the " ſettlement of New England. Our firſt planters " knew nothing of it; nor has it yet travelled " very far ſouth-weſt. It's firſt appearance in this " colony was on a marſh at Saybrook, to which an " old boat was brought down Connecticut river " by a great flood, and there caſt up. This in- " clined me to think, that it was originally an in- " land graſs, which happened to ſuit with ſuch " ſalt marſhes as are well ſupplied with freſh " water; and what confirms me in this opinion is, " that a perſon in the town of Killingworth, " where I reſide, having cleared a ſwamp far " diſtant from ſalt water, and afterwards ſent into " this freſh meadow cattle which had been fod- " dered with hay of the black graſs, had there in " a ſhort time (undoubtedly by means of it's " ſeeds carried thither in the dung of thoſe cattle), " a fine growth of this very graſs, which has ſince " not only eſtabliſhed itſelf, ſpread, extended, and, " like a conqueror, beaten out the natural graſs; " but looks as flouriſhing in that freſh meadow, " as any growing on a ſalt marſh.

" I have a large tract of peat meadow, in which " no graſs ſeeds will grow. I deſign to try the ſeed " of this black graſs in that dead freſh meadow, " ſince the other ſorts which I have tried do not " ſucceed. What encourages me to this, is my " having introduced it into a once uſeleſs worth- " leſs moraſs, worſe indeed than nothing, though " of conſiderable extent, for I was obliged to be " at the expence of fencing it, for the ſake of " other land. It was quite over-run with reeds, " buſhes, and brakes.

" Between this land of mine, and a creek of " ſalt water, intervened three meadow lots be- " longing to other perſons. I obtained leave " of the owners to cut a ditch ſix feet wide " through their ground, and carried this ditch to " the upper end of my land, where ſeveral croſs " ditches were then dug, to invite in, and retain, " the ſalt water. The gaping mouths of theſe " numerous ditches ſoon occaſioned a ſtrong in- " draught of ſalt water, and, in time, converted " the main ditch into a proper tide creek. The " ſalt water, thus introduced has done wonders. " It has not only killed the trees, buſhes, brakes, " and levelled great inequalities, but has alſo intro- " duced the black graſs, and thereby rendered the " acre of that land, which was not worth any thing " before, now worth thirty five pounds of our " currency.

" The ſalt water, in it's paſſage through my " neighbours grounds, has alſo done them great " ſervice, by introducing this black graſs; and all " this with ſmall expence."

APPEN-

APPENDIX,

Concerning the culture and uſes of

THE GREAT ANJOU CABBAGE.

AS this ſubject has already been touched upon *, though but ſlightly, for want of ſufficient information; I muſt beg the reader's pardon for reſuming it here, in order to give him the following much more ſatisfactory account of the culture of this very uſeful plant, with which I have ſince been favoured by the Marquis of Turbilly.

" The great Anjou cabbage is one of the moſt " uſeful leguminous plants, for country people. " It will grow in almoſt any ſoil, not excepting " even the moſt indifferent, provided it be ſuffi- " ciently dunged. It is but little known about " Paris, and in many other places, where it might " be cultivated to great advantage.

" The ſeeds of this cabbage are commonly ſown " in June, in a quarter of good mould in the " kitchen garden, which is watered from time to " time in caſe of drought. They will riſe pretty " ſpeedily, and ſhould be thinned ſoon after, " wherever they ſtand too thick. The next care " is to keep them free from weeds whilſt they " grow, by hoeing the ground between them. At " All-ſaints, they ſhould be tranſplanted into the " field where they are to remain. They ſhould be " planted there in trenches dug with a ſpade, " pretty deep; that is to ſay, they ſhould be " buried almoſt up to the leaves. The diſtance

* See *page* 194.

" between them ſhould be two feet, or two feet " and a half, every way, according to the good- " neſs of the ſoil. Particular care ſhould be taken " never to plant them with a dibble, as gardeners " plant other ſorts of cabbages. A layer of dung " ſhould be ſpread along the bottom of the trench, " and the roots of the tranſplanted cabbages " ſhould be covered therewith. The mould taken " out ſhould then be returned back upon this " dung; and, as the trench will then no longer " hold it all, there will remain a ridge between " each row of cabbages.

" Towards the middle of the next enſuing " month of May, the ground ſhould be well " ſtirred between the plants, with a ſpade, or ſome " other proper inſtrument, and it's whole ſurface " ſhould then be laid quite level. After this, " nothing more remains to be done, except pull- " ing up the weeds from time to time, as they " appear.

" Many husbandmen ſow the ſeeds of theſe " cabbages with thoſe of hemp; and though this " way be not ſo ſure as the former, it often ſuc- " ceeds very well, eſpecially in wet years. When " the hemp is pulled up, one finds a multitude of " little cabbages, which, having then a freer air, " afterwards grow apace. They are tranſplanted " at All-ſaints, in the manner before directed, and " are preferred to thoſe of the kitchen garden, " becauſe they are not ſo apt to run up to ſeed " the next ſpring: for that is an accident which " happens ſometimes to ſome of theſe cabbages, " in certain years; and it then becomes neceſſary " to replace them by others which have not run " up, and which are reſerved for this purpoſe in a " ſeparate ſpot of ground.

" Several farmers uſe a plough to cut the trench " for tranſplanting theſe cabbages: but then they " do not remove them till the ſpring, and leave

" them

" them in the mean while in the place where they " were ſown. They afterwards give the earth a " ſtirring with a ſpade, and lay it ſmooth, towards " the end of May, in the manner before directed. " One ſees in many farms in Anjou and Poitou, " whole fields of theſe cabbages, which are a very " great reſource.

" In the month of June, ſuch of theſe cab- " bages, which are already large, as do not turn " in their leaves for cabbaging, but ſtill continue " green, begin to be fit for uſe, and ſoon arrive at " their greateſt perfection, which they retain till " the next ſpring, when they begin to run up, " and afterwards bloſſom. Their ſeeds ripen to- " ward the beginning of July, and what is intend- " ed for ſowing ſhould be gathered then.

" In Anjou, when theſe cabbages are entirely " run up, they generally grow to the height of " ſeven or eight feet: ſometimes they reach to " eight feet and an half high, or nine feet; and " even yet taller ones have been ſeen.

" From the month of June, when theſe cabbages " begin to be fit for uſe, their leaves are gather- " ed from time to time, and they ſhoot out again. " They are large, excellent for ſoup, and ſo tender " that they are dreſſed with a moment's boiling. " They never occaſion any flatulence, or uneaſi- " neſs in the ſtomach, and they are alſo very good " food for cattle, which eat them greedily. They " likewiſe increaſe greatly the milk of cows.

" Such are the properties of this kind of cab- " bage, greatly eſteemed in Anjou, Poitou, Bri- " tany, the Maine, and ſome other neighbouring " provinces. In Anjou, farmers are even bound by " their leaſes, to plant yearly a certain number of " theſe cabbages, and to leave a certain number " of them ſtanding when they quit their farms.

" This cabbage forms a kind of ſhrub, the great " utility of which may be gathered from this;

" that it's leaves afford nouriſhment to men and " cattle, and it's ſtalk, which is about the thick- " neſs of one's wriſt, is uſed for fuel, when dry. " It therefore is a common ſaying in Anjou, that " every one of the cabbages is worth five ſols (two " pence halfpenny) a year.

" It ſometimes happens, in extremely ſevere " winters, that ſome of theſe cabbages are frozen; " and this is looked upon as a great loſs, in the " countries I have been ſpeaking of: but that " accident is rare; becauſe this kind of cabbage " reſiſts froſt better than moſt others.

" The ground where theſe cabbages are planted " ſhould be fenced in very carefully, by hedges, or " ditches, in order to preſerve them from the de- " predations of cattle, which are extremely fond " of them. With this precaution, I have made " ſeveral plantations of them near the houſes " which I have built in the midſt of the heaths " and commons that I have broken up and im- " proved; and they have ſucceeded well, though " the ſoil is but very indifferent in many places.

" I have, near my houſe in Anjou, two well in- " cloſed fields, deſtined for this ſort of plantation. " They are planted alternately, every year, with " young cabbages. When theſe are pulled up, " after they have ſeeded, in the ſecond year, at " the time before mentioned, the ground where " they ſtood is dug up, and ſowed with peas or " beans, the crop of which being taken off before " All-ſaints, makes room for planting of new " cabbages, at the proper ſeaſon. The ſoil is " looſened and enriched by the peas and beans, " and by this means the land never is reſted; " nor is it ever exhauſted, becauſe it is dunged " whenever the cabbages are planted.

" Theſe cabbages are of ſuch excellent ſervice " to me, that I have often wondered at their not

" being

" being cultivated in all the different countries " of Europe. I believe they would ſucceed every " where; and I adviſe all husbandmen to make " plantations of them. As their ſeeds are not " yet ſold at Paris, the beſt way will be to " procure them from one or other of the above " named provinces; and there, to be the ſurer of " them, from actual farmers.

" I wiſh that this ſhort memoir, founded on my " own experience, may contribute to extend the " culture of this very uſeful plant."

Reference to a drawing of M. de Lille's Scythe for mowing Wheat.

N. B. Several gentlemen, and particularly a moſt illuſtrious Society, to the leaſt intimation of whoſe deſire the greateſt deference is due, having wiſhed to ſee, in this work, a drawing of M. de Lille's ſcythe for mowing wheat (deſcribed in p. 381, of my firſt volume); I have, with pleaſure given it in *Plate IV*, *Fig.* 8. of this volume.

CHAP. V.

OF INCLOSING.

THE incloſing of lands, and dividing them into different fields, paſtures, &c. is a moſt eſſential part of their real improvement, and attended with many very conſiderable advantages; of which I ſhall here mention only the following.

Incloſures aſcertain to every man his juſt and due property, and thereby prevent an infinity of treſpaſſes, injuries, and other ſources of ruinous litigation. They keep the land warm, and add to it's fertility, by ſcreening it from violent and nipping winds, which otherwiſe frequently deſtroy whole crops; and they alſo defend it from thoſe drying and ſcorching winds, which ſo often blaſt at once the husbandman's, till then well grounded, expectation. They afford ſhade in the ſummer, and ſhelter in the winter, for cattle which would otherwiſe deſtroy more with their feet, than they eat with their mouths, and which for want of theſe, might, as Mr. Worlidge obſerves [a], loſe more of their fat or fleſh in one ſultry day, than they gain in three cool ones. Their cuttings afford fuel to the induſtrious huſbandman, and, if carefully planted and preſerved, they will here and there furniſh him with timber for his carts, ploughs and other utenſils, beſides, ſometimes uſeful fruits. They are an excellent encouragement to good husbandry, and a great remedy againſt beggary, by employing many poor people in the labour which either the making, or

[a] *Syſtema Agriculturæ, p.* 11.

the

Fig. 1

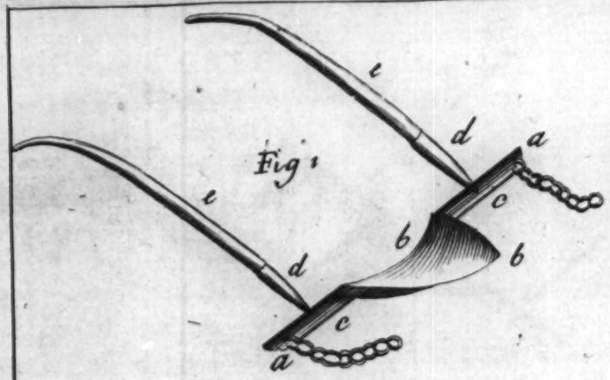


Fig. 2

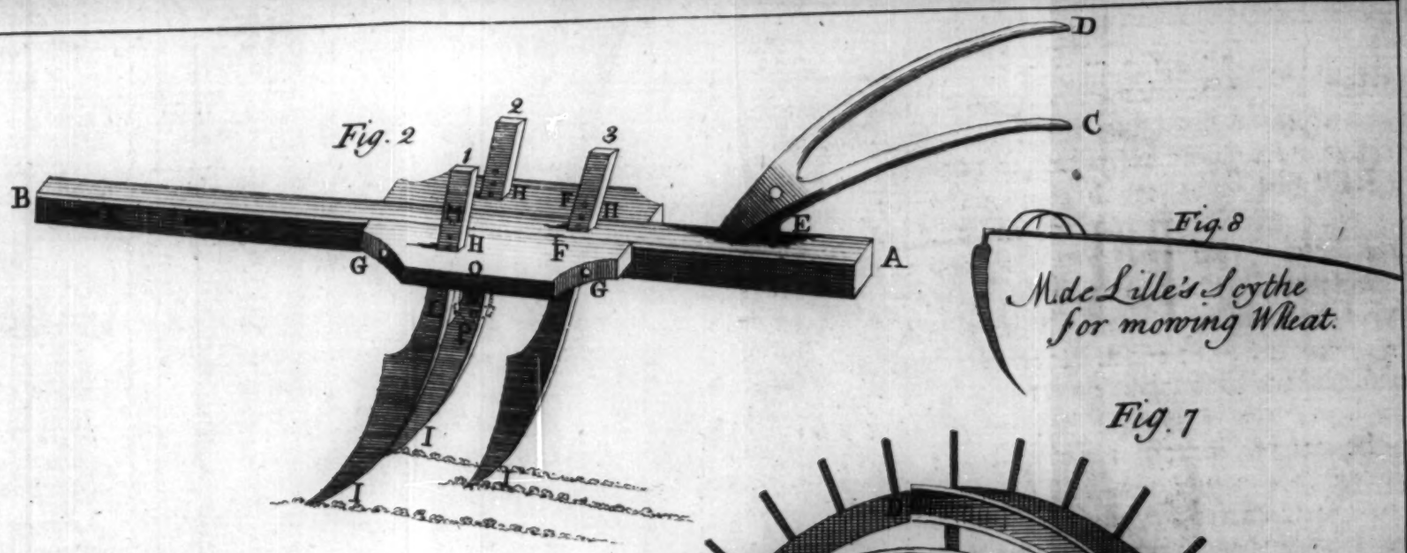


Fig. 8

Mde Lille's Scythe for mowing Wheat.

Fig. 7

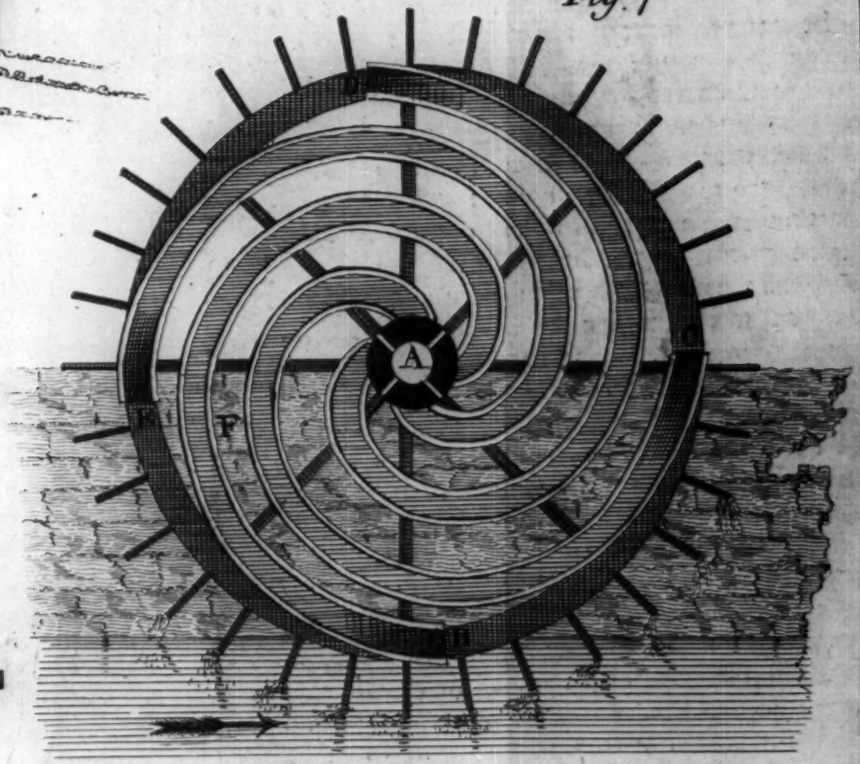


Fig. 3

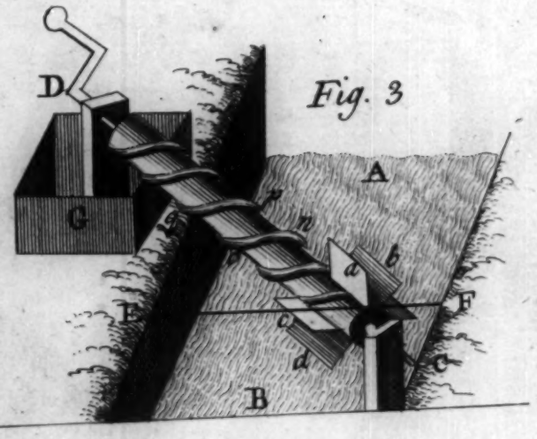


Fig. 6

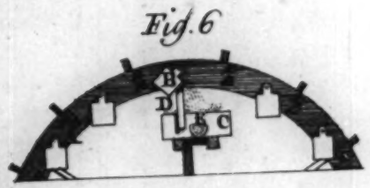


Fig. 5



Fig. 4

the mending, of them conſtantly requires, and which is amply repaid by the increaſe of crops: for it has been remarked, not only that well incloſed countries generally maintain treble the number of inhabitains, or more, than the champaign; but alſo, that thoſe inhabitants are much better fed, and clad, than the common run of people in unincloſed lands.—To be convinced of this, let any one but examine our vaſt downs, commons, heaths, waſtes, and unimproved foreſts; badges yet remaining, as Mr. Worlidge properly terms them, of poverty and idleneſs: but at the ſame time, thoroughly ſuſceptible of being converted, with proper care, into corn and paſture fields, meadows, gardens, orchards, and pleaſant groves; the marks of induſtry and good husbandry. Let him but compare the naked parts of Wiltſhire, Glouceſterſhire, Hampſhire. Surry, &c. with the delightful parts of Kent, Herefordſhire, and other counties; and he cannot but be ſtruck with a demonſtration of the immenſely valuable improvements which may yet be made in very many parts of this kingdom. The now un-improved, un-occupied, crown-lands, might, alone, or even only a part of them, be rendered an inexhauſtible ſourſe of unequalled wealth to the Sovereign, of a vaſt increaſe of his ſubjects, and of happineſs to all. — Objects ſurely well worth the attention of the Legiſlature! eſpecially after the long and expenſive war in which this nation has been engaged, and to which OUR KING has put a moſt glorious end.

The common objections againſt incloſures have been ſo well refuted by many very able writers, and are daily invalidated by that moſt unerring teſt, experience, that it would be needleſs for me to recapitulate them here. I therefore ſhall only point

point out one farther eſſential advantage attending this great improvement, which is, that it enables the farmer to act as is moſt-agreeable to him, in ſowing when, and what, he pleaſes.

Every gentleman whoſe eſtate is not yet incloſed, and who is conſequently at liberry to chooſe the manner and means of doing it, will rationally begin with having a map of it drawn, that he may thereby be enabled to divide and portion it out, with the greater propriety and preciſion, ſo as to render it moſt pleaſing to the eye, and moſt convenient to each farmer. If he has a place of reſidence upon it, he may make the whole become ornamental to that reſidence, by a judicious diſpoſition of his hedges and plantations; as has been nobly done at Boughton, in Northamptonſhire, by the late Duke of Montague, who, with a moſt refined taſte, and truly benevolent mind, diſdaining all the little and confined ornaments of a park, executed his fine improvements there in ſuch a manner as to render them pleaſingly benefical to all his neighbours, as well as to every perſon ſettled upon his land. —— Gubbins, in Hertfordſhire, the ſeat of Sir Jeremy Sambrook, is another charming example of elegance, though leſs extenſive than the former.

Ha-ha walls, and pieces of water with rails running acroſs them, are an eaſy means of preſerving a fenced level.

The farms ſhould be ſo divided, that the dwelling of each tenant may be as contiguous to his land as conveniency will admit of; to prevent length of carriage, and to facilitate his due attendance.

Small farms have always been obſerved to yield the greateſt proportional rent, and ſmall incloſures conſtantly produce the moſt plentiful crops.

Incloſures

Incloſures for arable land ſhould be larger than for paſtures; that the ſoils may be kept dry, and the corn be well aired: for this will contribute greatly to prevent mildew, and other diſtempers ariſing from two much moiſture.

As foreſt trees, by their ſhade and wide extended roots, are found to be manifeſtly injurious both to corn and graſs, none of them ſhould ever be admitted into the hedges which divide fields: but, as they are uſeful and neceſſary, the landlord ſhould rather ſkirt his eſtate with plantations of them, or divide it by ſuch plantations, ſo as to give it warmth and ornament.

In countries where, in lieu of hedges, the fences are chiefly made of rough flakes of ſtone piled dry one upon another, with either a little clay at the top, to keep them together, or a little earth thrown in between their chaſms; a plantation of trees within theſe will hide their deformity, and give a warmth which is not to be expected from ſuch walls.

The moſt uſual way of incloſing land is with a ditch and a bank ſet with a hedge, of hawthorn, crabs, black-thorn, holly, or, which is more common, of white-thorn, or, quick. Mr. Miller's directions in this reſpect are very ample, and contain, among others, the following uſeful inſtructions [b].

"It will be proper, before planting, to conſider the nature of the ſoil, and what ſorts of plants will thrive beſt in it; and alſo what the ſoil is from whence the plants are to be taken: for if the ground they are taken from is better than that into which they are to be put, it will be more difficult to make them grow. Thoſe which have been raiſed on a ſpot near the place where they are intended to be ſet, will always do beſt, if they

[b] *Gardener's Dict.* Art. FENCES, and HEDGES.

are

are to be tranſplanted; and the next to them will be ſuch as are taken from a nurſery.

"I would recommend the white-thorn, the black-thorn, and the crab, for outward fences to good ground: but I do not approve of intermixing them.

"The white-thorn is the beſt quick to plant, becauſe it is the moſt eaſily procured, is very hardy and durable, and may be rendered the cloſeſt of any fence, by proper clipping. It therefore is preferred to all others for outward fences, or for the diviſion of fields, where they are expoſed to cattle, &c. It may be raiſed either from ſets or from ſeeds. The former is the moſt common way of propagating it: for the latter, which may very properly be ſown where the hedge is intended to ſtand, do not riſe till the ſecond ſpring. The white-thorn will thrive on almoſt any well looſened ſoil, except the drieſt gravel or ſand.

"The black-thorn and crab make very good fences, and are to be raiſed in the ſame manner as the white-thorn: but if the kernels of apples or crabs be ſown, it is beſt to ſow the pommace with them; for they will then come up the ſooner, that is to ſay, the firſt year.

"The black-thorn is not accounted ſo good for fences as the white-thorn, becauſe it is apt to run more into the ground, and is leſs certain as to the growing: but, on the other hand, it's buſhes are much better, and more laſting, than thoſe of the white-thorn, or indeed any other ſhrub, for dead hedges, or to mend gaps: nor are they ſubject to be cropt by cattle, as the others are. The richer the mould is, the better the black-thorn will proſper: but it will grow on the ſame ſort of ſoil as the white-thorn.

"The holly makes an excellent fence, and is preferable to all the reſt; but it is difficult to be made

made to grow at firſt, and is a ſlow grower. However, when it does grow, it makes amends by it's height, ſtrength, and thickneſs. It delights moſt in ſtrong grounds; but will grow upon the drieſt gravel, even among rocks and ſtones. It is raiſed from ſets, or berries, as the white-thorn is; and theſe berries, like the hawes of the white-thorn, lie till the ſecond ſpring before they come up. Theſe two are beſt ſown in the place where they are intended to ſtand. They ſhould be well weeded, both before they come up, and afterwards, till they are grown to ſuch a ſize, as, of themſelves, to kill the weeds.

" French furze will make good hedges upon dry ſandy banks, where few other plants will grow: but they muſt be kept very clean at the bottom, and never ſuffered to grow too high: nor ſhould they be clipped either in dry weather, late in autumn, or early in the ſpring; becauſe the cutting of them then is apt to make them die in patches, which are irrecoverable; as no new ſhoots will here ever proceed from the old wood.

" Alder planted on a bank, the ſide of which is waſhed with a river or ſtream, will make an extraordinary fence, and preſerve the bank from being undermined by the water; becauſe it is continually putting forth, from the lower roots, ſuckers which are of great advantage where the current waſhes away the earth.

Sticks of elder, ten or twelve feet long, ſtuck ſloping in a bank, ſo as to form a kind of chequer work, will produce the quickeſt, though not the ſtrongeſt, hedge of any thing, and will be a good ſhelter.

" If there is to be a ditch along the hedge, that ditch ſhould be at leaſt ſix feet wide at top, three feet deep, and but one foot and an half over at the bottom, that each ſide may have a proper ſlope: for where it's ſides are dug too perpendicular,

cular, they are very apt to fall in after a hard froſt, or heavy rain; and if the ditch is made narrower than here directed, it will ſoon be choaked up in autumn, by the falling leaves, and the growth of weeds: nor will it be a ſufficient defence to the hedge againſt cattle.

"When the bank at the ſide of this ditch is to be planted with quicks, the ſets ought to be about as thick as a gooſe quill, and their tops ſhould be cut off to within four or five inches of the ground. They ſhould be freſh taken up, ſtrait, ſmooth, and well rooted. Part of the turf taken off the ſurface of the ground where the ditch is to be dug, ſhould be laid, with the graſs ſide downward, on that ſide of the ditch where the bank is intended to be made, and ſome of the beſt mould ſhould be laid upon it, to bed the quick. The ſets of quick, prepared as before directed, are then to be laid upon that mould, a foot aſunder, with their cut ends ſloping ſomewhat upward. When this firſt row of quick is thus laid, it muſt be covered with mould; ſome of the remaining turf muſt then be laid upon that mould with the graſs ſide downward, as before; and more mould muſt afterwards be laid upon this turf. When the bank has, by theſe means, been raiſed about a foot high, a ſecond row of ſets ſhould be laid in the ſpaces between the lower quick, and with their ends turned the oppoſite way, in order to thicken the bottom of the hedge. Theſe are then to be covered in the ſame manner as the former: the bank is to be topped with the bottom of the ditch; and a dry, or dead, hedge muſt be made on the other ſide, to defend the young plantation from cattle.

"To make theſe dead hedges, ſtakes ſhould be driven into the looſe earth, ſo low as to reach the firm ground. They ſhould be about two feet and

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an half aſunder. Oak ſtakes are reckoned the beſt, and black-thorn and ſallow the next. When theſe are fixed, ſmall buſhes ſhould be laid at the bottom, but not too thick; for that would make the buſhes rot. The upper part of the hedge ſhould be laid with long buſhes, to bind the ſtakes in, by interweaving them: and, to render this hedge yet ſtronger, it may be eddered, as it is called, that is to ſay, the tops of the ſtakes may be bound in on each ſide with ſlender long poles or ſticks. When this eddering is finiſhed, the ſtakes ſhould be driven anew; becauſe that, and the weaving of the hedge, will probably have looſened them.

"The quick muſt be kept conſtantly weeded, and ſecured from being cropped by cattle, and in February it ſhould be cut to within an inch of the ground: for this will make it ſhoot ſtrong, and greatly help it's growth.

"When a hedge of this kind is about eight or nine years old, it will be proper to plaſh it; the beſt time for which is in October or February.

After it has ſtood twenty or thirty years, and there are in it old ſtubs, as well as new ſhoots, thoſe ſtubs ſhould be cut ſloping off within two or three inches of the ground, excepting the beſt and longeſt of the middle ſize, which ſhould be left to lay down, and ſome of the ſtrongeſt, which ſhould be cut off at the height of five or ſix feet, according to the intended height of the hedge. Theſe laſt may be left to ſerve inſtead of ſtakes, and freſh ſtakes ſhould be put wherever they are wanted. The hedge ſhould be thinned, ſo as to leave on the ſtubs only ſuch ſhoots as are deſigned to be of uſe, that there may be room left to put a ſpade in between them, in order to give the earth as good a ſtirring as can be. The ditch

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alſo ſhould be cleanſed, and it's ſlopes carefully repaired; and where the earth has been waſhed from the roots of the quick, or is hollow, it ſhould be faced anew with ſo much of the firſt ſpit of earth that is dug out of the ditch, as there is occaſion for. The ſecond ſpit of this earth ſhould be laid on the top of the bank: for if it be laid on the ſide, or face of the bank, it will ſlip into the ditch again when wet comes, and perhaps drag down a great deal of the bank.

"Two extremes are to be avoided in the plaſhing of quicks: the firſt is, laying the plaſhes down too low, and too thick; becauſe that makes the ſap run wholly into the ſhoots, and leaves the plaſhes without nouriſhment, which, with the thickneſs of the hedge, kills them. The ſecond is, not to lay them too high; becauſe this draws all the ſap into the plaſhes, ſtints the ſhoots at the bottom, and renders the hedge ſo thin, that it will neither hinder cattle from going through, nor from cropping of it.

"When the ſhoot deſigned to be plaſhed is bent, give it a ſmall cut with a bill, half through, ſlanting a little downward; then weave it about the ſtakes, and trim off the ſmall ſuperfluous branches that ſtraggle too far out on either ſide of the hedge.

"If the ſtubs are very old, cut them quite down: ſecure the chaſms with a good dead hedge on each ſide, till the young ſhoots are got up tall enough to plaſh; and plant new ſets in the vacant ſpaces.

"If the bank for a fence be without a ditch, and it is intended to make a hedge of quicks, the ſets, prepared as before, ſhould be planted in two rows, almoſt perpendicular, at the diſtance of a foot from each other, in the quincunx order; ſo that, in effect, they will be but ſix inches aſunder.

When the plants of the thorn are themſelves ſtinted, or much decayed, as they generally are pretty ſoon, through the unmerciful wounds given them by unſkilful hedgers; inſtead of plaſhing them, the farmer's beſt way will be to dig them up, and plant young ſets in their ſtead. The only inconvenience attending this renewal, is the expence of a dead hedge, which is not wanted in plaſhing: but I queſtion much, whether the healthineſs of the plants, when cut ſmooth, and in ſuch a manner as not to retain water, may not ſufficiently compenſate that charge. For the ſame reaſon, it ſeems to me moſt rational to cut the plaſhes upward; becauſe the wound will then be covered from the wet, at leaſt in ſome degree, by the ſlip which remains prominent over it.

Beſides the plants already mentioned for hedges, the ſweet-briar, or eglantine (dog-roſe), is thus recommended by a correſpondent of the Society of Improvers in the knowledge of Agriculture in Scotland, who had tried in vain, in that country, all the methods of fencing uſually practiſed in Hampſhire and Eſſex[c].

"Obſerving that no creature ate up or deſtroyed the ſweet-briar or elegantine (dog-roſe), I gathered the hips of this plant, and laid them in a tub till March: the ſeeds then rubbed out eaſily, and I ſowed them in ground prepared for garden-peas. By this means I got my crop of peas without prejudice to my briars, which came up the next year; and the year after, when they were about a foot high, I planted them in the following manner.

"After marking out my ditch, I laid my plants about eighteen inches aſunder upon the ſide graſs, and covered their roots with the firſt turfs

[c] MAXWELL's *Miſcellaneous Papers on Huſbandry*, p. 149.

" that were taken off the ſurface of the intended
" ditch. The earth ſide of theſe turfs was placed
" next to thoſe roots, and upon the turfs was
" laid other earth, taken out of the ditch, which
" I then finiſhed. In four or five years, theſe
" plants made a fence which no ſheep, cattle, or
" horſes could paſs. If old briars are dug up, and
" divided, they make excellent plants. Where the
" fences are thin, they may be eaſily thickened,
" by laying down branches; for theſe will make
" ſhoots of ſix or ſeven feet in a year. They bear
" clipping very well.

" In ſandy places, I ſeldomdare to throw all the
" earth out of the ditch at once, but wait a year,
" till what I had thrown up is ſettled and ſwarded
" a little: then I raiſed my bank to the intended
" height. In the mean time nothing hurts my
" briars; and in two or three years after they have
" been planted, nothing can paſs the fence. Sheep
" ſometimes attempt it: but they ſoon are ſo in-
" tangled, that they would lie there till they die,
" if they were not taken out."

In the hedges which divide the farmer's fields only, fruit trees may be planted; and theſe will yield profit, as well as ornament: or the fruit may be grafted upon a ſtock in the hedge, properly ſuited thereto.

Theſe ſtocks ſhould be pruned up every year, till they are brought out of the reach of cattle, and then they may be grafted with the red-ſtreak, gennetmoil, or any other fruit. If they have proceeded from apple-kernels, they may remain ungrafted, and will yield very good cyder fruit: but then it will be longer before they bear. Alſo, if the leaf, ſhoot, and bud of a natural ſtock promiſe more than common, a trial may be made, whether that ſtock will not perhaps produce a fine new fruit;

fruit; and if it be not liked afterwards, it may then be grafted [d].

Mr. Miller reckons the plants raiſed from the kernels of the ſmall wild crab much better for hedges, than thoſe which are raiſed from the kernels of any other ſort of apple; becauſe the former never ſhoot ſo ſtrong as the latter, and therefore may be better kept within the proper bounds of a hedge; and as they generally have more thorns upon them, they are better guarded againſt cattle.

Fences made in marſhy grounds require plants which delight in moiſt ſoils. Of this kind are, particularly, the black alder, the willow, and the poplar: the birch tree, and the aſh will likewiſe grow very well in ſuch places: but the firſt of theſe, *viz.* the alder, is reckoned the beſt and moſt profitable.

It likes a ſoil ſo moiſt as few other trees will thrive in, and is propagated either by layers, or planting of truncheons about three feet in length. The beſt time for planting theſe laſt is in February or the beginning of March, when they ſhould be ſharpened at their larger end, and the ground ſhould be well looſened before they are thruſt into it, leſt the bark ſhould be torn off, which may occaſion their miſcarriage. They ſhould be ſet at leaſt two feet deep, to prevent their being blown out of the ground by violent winds, after they have made ſtrong ſhoots; and they ſhould be kept clear from all ſuch weeds as grow tall, at leaſt till they have got good heads: after this, they will keep down the weeds, and require no farther care.

If alders are raiſed by laying down the branches, this ſhould be performed in October, and by the

[d] Miller's *Gardener's Dict.* Art. Hedges.

ſame time twelvemonth they will have roots ſufficient to be tranſplanted, which muſt be done by digging a hole, and looſening the earth in the place where each plant is to ſtand. The young ſets muſt be planted at leaſt a foot and a half deep, and their top ſhould be cut off to within about nine inches of the ground; for this will make them ſhoot out many branches.

The alder tree may be trained into very thick cloſe hedges, to the height of twenty feet and upwards. It will thrive exceedingly on the ſides of brooks, for it grows beſt when part of it's roots are in the water, and may, if planted there, as is uſual for willows, be cut for poles every fifth or ſixth year. It's wood makes excellent pipes and ſtaves; for it will laſt a long time under ground, or in water: and it is likewiſe much eſteemed by turners, plough-wrights, &c. and for making ſeveral utenſils neceſſary in agriculture. It's bark yields a good black dye.

All the ſorts of willows, of which Mr. Miller enumerates fourteen [c], grow beſt in moiſt boggy land, and may be eaſily propagated by planting cuttings or ſets, either in the ſpring or autumn: for theſe readily take root, and are of quick growth.

Thoſe ſorts which grow to be large trees, and are cultivated for their timber, are generally raiſed from ſets about ſeven or eight feet long, ſharpened at their larger end, and thruſt into the ground by the ſides of ditches and banks, where the ſoil is moiſt: but the beſt way is to make holes for them with an iron inſtrument, in order to avoid tearing off their bark. Theſe will afford very profitable loppings every fifth or ſixth year.

[c] *Ibid.* Art. SALIX.

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The middle ſized, or long leaved red willow (*Salix folio longo ſubluteo non auriculata*, Raii Syn.), and the common ſallow (*Salix folio ex rotunditate acuminato*), C. B. P. 474; willow with a rounded acute-pointed leaf), have very pliable ſhoots, and therefore are the fitteſt for baſket makers, for which reaſon they are much planted in oſier grounds. The cuttings of theſe plants ſhould be about three feet along, and taken from ſtrong ſhoots of the former year. They are commonly thruſt down two feet deep into the ground, and ſhould be about eighteen inches aſunder, if intended only for a fence; but if they are deſigned alſo for an oſier plantation, the rows, in which they may ſtill be at that diſtance, ſhould be three feet aſunder; obſerving always to plant the rows the ſloping way of the ground, eſpecially if tides overflow it; becauſe, if the rows are placed the contrary way, the filth and weeds that will be detained by the ſets will choak them up.

The beſt ſeaſon for planting theſe cuttings is towards the end of February, for if they are planted ſooner and a hard froſt comes on, they are apt to peel, which greatly injures them. Theſe plants are cut every year in oſier grounds, and, if the ſoil be good, they will yield ſo great a crop, that the yearly produce of one acre has often been ſold for fifteen pounds: but ten pounds is a common price. It therefore is great pity that willows are not more cultivated, eſpecially upon boggy land, where few other things will thrive. They will not, however, do ſo well as the alder, in very watery ground. Great care ſhould be taken to ſcreen the young willows from cattle; for they are fond of them, and would ſoon deſtroy them irrecoverably, by nipping off their young ſhoots. In wine countries, the boughs of this tree are uſed, either whole or ſplit, according to their ſize,

for props to vines; and hoops for barrels are alſo made of them. The large wood, if ſound, is ſold to ſhoemakers for wooden heels, and to turners for many kinds of light ware.

The poplar may be propagated either from layers or cuttings, which will readily take root; and alſo from the ſuckers which the white ſort, commonly called the *abele* tree, ſends up in great plenty from it's root's. The beſt time for tranſplanting theſe ſuckers is in October, when their leaves begin to decay. Theſe may be planted in a nurſery for two or three years, to get ſtrength, before they are planted out where they are to remain: but for planting of cuttings, the beſt time is the latter end of February, when truncheons two or three feet long, ſharpened at their lower ends, may be thruſt about a foot and a half deep into the ground, where, if the ſoil be moiſt, they will readily take root, and arrive at a conſiderable bulk in a few years.

The black poplar is not ſo apt to take root from large truncheons: wherefore the better way, with this, is to plant cuttings of it about a foot and half long, and about a foot deep in the ground. Theſe will take root freely, and may afterwards be tranſplanted where they are to remain. This ſort will grow upon almoſt any ſoil, but will thrive beſt in moiſt places. It therefore flouriſhes remarkably on the ſides of rivers, ponds, canals, &c.

Mr. Miller ſays [f] he has planted cuttings of this tree, which in four years have been bigger in the trunk than a man's thigh, and near twenty feet in height, and this upon a very indifferent ſoil: but in a very moiſt ſoil, it is common for theſe trees to ſhoot eight or ten feet in a ſeaſon: ſo that

[f] *Gardener's Dict.* Art. POPULUS.

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where a perſon wants to make a ſhelter in a few years, there is ſcarce any tree ſo proper for the purpoſe as this is. The Memoirs of the Berne Society caution us not to plant poplars too much within a meadow, leſt their roots ſhould damage the graſs; to which they add, that their leaves are excellent food for ſheep [g].

It is rightly obſerved by the experienced gardener before mentioned [h], that a conſiderable advantage may be made by planting theſe trees upon moiſt boggy ſoils, where few others will thrive. There are in England many ſuch places, which do not now bring in much money to their owners; whereas, if they were planted with poplars, they would, in a very few years, over purchaſe the ground, clear of all expences. But it is a too common opinion, that nothing but corn is worth cultivating in England; or if timber be planted, it muſt be oak, aſh, or elm; and if the land be not proper for either of theſe, it is deemed of little value: whereas if the nature of the ſoil was examined, and proper plants were adapted to it, great profit might be made by ſeveral large tracts of land, which at this time lie neglected.

The wood of the poplar, and eſpecially that of the *abele*, which is much eſteemed on account of it's great whiteneſs, is very good for laying floors, where it will laſt many years; but, being of a ſoft contexture, it is very ſubject to take the impreſſion of nails. &c, which renders it leſs fit for this purpoſe. It is alſo very proper for wainſcotting rooms, becauſe it is leſs apt to ſwell or ſhrink, than moſt other ſorts of wood. For turnery ware, none is equal to this for it's exceeding whiteneſs, and great lightneſs; wherefore trays, bowls, and

g *Tom.* III. *Part.* I. *p.* 97.

h Mr. MILLER, *ubi ſupra.*

many other utenſils are made of it; and the bellows makers prefer it for their uſe; as do alſo ſhoe-makers, not only for heels, but alſo for the ſoles of ſhoes. It is likewiſe very fit to make light carts; the poles of it are very proper to ſupport vines, hops, &c. and it's loppings afford good fuel, which is a valuable article in many countries.

The birch tree, which will grow on almoſt any ſoil, be it ever ſo barren for other plants, thrives equally well in moiſt ſpringy land, or in dry gravel or ſand, though the ſurface be but very ſhallow. It has ſucceeded ſo well, even upon ground which produced nothing but moſs, that it has been fit to cut in ten years after planting, when an acre of theſe trees has ſold for near ten pounds, ſtanding, and the after produce has been conſiderably increaſed [i].

The beſt way to cultivate this tree is to take young plants of it from the woods, where they naturally grow, and are generally found in great plenty: but in places where no young plants can be procured, they may be raiſed from ſeeds, which ſhould be carefully gathered in the autumn, as ſoon as the ſcales under which they are lodged begin to open: otherwiſe they will ſoon fall out and be loſt. Theſe ſeeds are ſmall, and therefore ſhould not be buried deep in the ground. The autumn is the beſt ſeaſon for ſowing them; and if this be done in a ſhady ſituation, the plants will thrive better than when they are expoſed to the full ſun.

When young plants of birch are taken from out of woods, in order to be tranſplanted, they ſhould be carefully dug up, ſo as not to injure their roots. The ground in which they are to be ſet will not need any other preparation, than

[i] MILLER's *Gardener's Dict.* Art. BETULA.

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looſening it with a ſpade or mattock in the places where the plants are to ſtand, making holes to receive their roots, and cloſing the earth hard to them after they are ſet. If the plants are young, and have not much top, they will not require pruning: but if they have buſhy heads at the time of their being tranſplanted, thoſe heads ſhould be trimmed, or ſhortened, to prevent their being ſhaken and diſplaced by the wind. After the plants have taken root, the only care requiſite is, to cut down the great weeds which would overhang them. This may be done with a ſickle, ſo as not to cut or injure the young trees: nor need it be repeated oftener than twice in a ſummer during the two firſt years: for the plants will afterwards be ſtrong enough to keep down the weeds, or at leaſt be out of danger from them.

Theſe young birches may be tranſplanted at any time between the middle of October and the middle of March, when the ground is not frozen; but autumn is the beſt ſeaſon for planting them in dry lands, and ſpring for ſetting them in a moiſt ſoil. The diſtance at which they ſhould be planted is ſix feet ſquare, that they may ſoon cover the ground, and by ſtanding cloſe draw up each other: for they will not thrive ſo well, if they are not pretty cloſe, in ſituations where they are much expoſed.

If the plants take kindly to the ground, they will be fit to cut in about ten years; and after that they may be cut every ſeventh or eighth year, if they are deſigned for broom makers only: but when they are intended for hoops, for which they are excellent, they ſhould not be cut oftener than every twelfth year. The larger trees are often bought for turner's ware; and this wood is alſo uſed for making ox-yokes, and other inſtruments of huſbandry. In ſome of the northern parts of Europe,

Europe, it is much eſteemed for making of carriages and wheels; being hard and durable. In France, it is generally uſed for making wooden ſhoes. It makes very good fuel; and the author of a diſſertation in the memoirs of the Berne Society ſays [k], that it's aſhes are an excellent remedy for an *eryſipelas*, or St. Anthony's fire: but he does not tell us how they are to be uſed.

In ſome places, theſe trees are tapped in the ſpring, and the ſap is drawn out to make birch wine, which has been recommended for the ſtone and gravel; as is alſo the ſap unfermented. The bark of the birch tree is almoſt incorruptible. Many houſes in Sweden are covered with it, and it laſts many years. It frequently happens, that the wood of this tree is entirely rotten, and the bark perfectly ſound and good.

To make a plantation of birch, in places where the young plants can be eaſily procured, will not coſt above forty ſhillings an acre, and the after expence of cleaning will not exeed twenty ſhillings more; ſo that the whole will not be more than three pounds: and if the land be of ſo little value as not to be worth attempting to fit it for any other growth, the proprietor cannot make a better uſe of his money; for when the wood is cut, it will repay the diſburſement with intereſt, and a perpetual ſtock will remain upon the ground. Mr. Miller ſays [l] he has ſeen ſeveral of theſe plantations made upon land which would not let for one ſhilling an acre, and which has afterwards produced from ten to twelve pounds an acre, clear of the expence of cutting, every twelfth year.

The aſh, of which our common ſort is the moſt hardy, moſt laſting, and fineſt grained, and conſe-

[k] *Tom.* III. *Part.* I. *p.* 98.

[l] *Gardener's Dict.* Art. BETULA.

quently

quently the moſt valuable, will likewiſe thrive in low and moiſt places, as well as on high and dry grounds [m].

The ſeeds of this tree ſown as ſoon as they are ripe, will come up the following ſpring; but if they are not ſown till the ſpring, they will remain a year in the ground, which, in the mean time, ſhould be kept clear of weeds, and not diſturbed, for fear of turning out the ſeeds, or burying them too deep. When the plants are come up, they muſt be carefully weeded during the enſuing ſummer, and if they make good progreſs in the ſeed bed, they will be fit to tranſplant by the autumn; the moſt proper time for which is, when their leaves begin to fall. Great care ſhould be taken not to break or tear off their roots in tranſplanting them; for which reaſon it is much better to dig them up with a ſpade, than to draw them out by hand, as is commonly practiſed, in order to have the largeſt only, and leave the others for a ſecond year's growth before they are removed. But the purpoſe of thus ſeparating them is very eaſily anſwered, without the danger of injuring their roots, by digging up all, and then planting them in different rows, according to their ſizes. The younger they are planted out, the larger they will grow: and it is of conſequeece that the ſoil from whence they are taken, or in which they are raiſed, be not better than that in which they are to remain: for when any plants are raiſed in good land, and afterwards tranſplanted into worſe, they very ſeldom thrive. The beſt way of all is therefore to ſow them on the ſpot where they are moſt wanted: for they may eaſily be thinned afterwards; and it will be found that thoſe which are

[m] *Mémoires de la Societé Oeconomique de Berne, Tom.* III. *p.* 97.

left

left ſtanding will grow to a larger ſize than ſuch as are tranſplanted [n].

People who live in the neighbourhood of aſh trees may eaſily ſupply themſelves with plenty of ſelf-ſown plants, if cattle have not been ſuffered to graze on the land: for if they can come at them, they will eat them up as faſt as they appear. If, indeed the ſeeds of the aſh happen to fall under hedges, where they are protected by buſhes, the plants will come up and thrive; and, through the ignorance, or inattention of ſome huſbandmen, they are too frequently permitted to grow there till they have deſtroyed the hedge itſelf: for there is ſcarce any tree ſo hurtful to all kinds of vegetables, as the aſh, which robs every plant of the nouriſhment that is within the reach of it's roots. This tree ſhould therefore never be ſuffered in hedge-rows: nor ſhould it ever be permitted to grow near paſture grounds; for if cows eat of the leaves or ſhoots of the aſh, all the butter that is made of their milk will be exceſſively rank. Such is the quality of the butter which is made about Guildford, Godalmin, and ſome other parts of Surry, where there are aſh trees about all the paſtures — In the good dairy countries, not an aſh tree is ſuffered to grow [o].

This timber is of excellent ſervice to wheel-wrights and cart-wrights, for ploughs, axle-trees, wheel-rings, harrows, &c. It is alſo uſed by cabinet-makers, when it is ſound and knotty; and likewiſe for oars, blocks for pullies, and many other purpoſes.

The beſt ſeaſon for felling theſe trees is from November to February: for if it be done either too early in autumn, or too late in the ſpring, their timber will be apt to become worm-eaten: but

[n] MILLER's *Gardener's Dict.* Art. FRAXINUS. [o] *Id. ibid.*

for

for lopping of pollards, the ſpring is moſt eligible for all ſoft woods.

In countries where there is great plenty of rough flat ſtones, the fences which bound an eſtate, or farm, are frequently made with them. It is a pretty common practice in Devonſhire and Cornwall, where they build as it were two walls with theſe ſtones laid one upon another, firſt two, and then one between; and as the walls riſe, they fill the intermediate ſpace with earth, beat the ſtones in flat to the ſides, which makes them lie very firm, and ſo proceed till the whole is brought to the intended height. They then plant upon theſe walls quick hedges, and even timber trees[p], which thrive exceedingly; and they eſteem theſe fences the beſt ſecurity that can be to their ground and cattle. — However, if theſe ſtones are laid rough and dry, they cannot but be diſagreeable to the eye, and muſt certainly require frequent repairs, becauſe they will frequently be forced out of their places, or beaten down, by cattle.

To prevent this, let ſuch walls be built in the bottom of a ditch, made wide enough for the purpoſe, and ſloped down on each ſide. The deformity will then be hid: and as the cattle cannot ſtand facing the wall, ſo as to attempt to leap over it, the ſtones of which it is compoſed will be the leſs liable to be beaten down. The earth taken out of the ditch may be ſpread on the adjacent ground, and it's ſides may be planted with ſuch trees, or under-wood, as beſt ſuit the ſoil. If a ſpace of ſeveral feet, proportioned to the demand which there may be for timber, is left on the inſide of the fence, it will be attended with every advantage ariſing from a ſupply of that neceſſary commodity, without prejudice to the arable, or more valuable paſture.

[p] MORTIMER's *Art of Huſbandry*, *Vol.* I. *p.* 3.

Another

Another very ſtrong and durable fence may be formed thus, in graſſy places. Dig pieces of turf, four or five inches thick, the breadth of your ſpade, and about a foot long. Lay theſe turfs even, by a line, on one ſide, with the graſs outward, at the diſtance of ten or twelve inches within the mark at which the ditch, afterwards to be dug in the ſolid ground, is to begin. Then lay in the ſame manner, but with their graſs ſides turned out the contary way, another row of turfs, at ſuch diſtance as to make a breadth of foundation proportioned to the intended height of the bank. The reaſon for placing theſe turfs thus much within what is to be the edge of the ſolid ground dug away on each ſide, is, to prevent the bank from falling in, if the ground underneath it ſhould be any way defective. A ditch, of what breadth or depth you pleaſe, may then be dug; or the ground may be lowered on each ſide with a ſlope; in which laſt caſe there will be no loſs of paſture by the fence, becauſe it may be ſowed with hay ſeeds, and will bear graſs on both ſides. Part of the earth taken out of the ditches or ſlopes, will fill the chaſm between the rows of turf, and the reſt may be ſcattered over the adjacent ground. Three, four, or more layers of turf may be thus placed one upon another, and the interval between them filled up as before, till the bank is brought to the deſired height; only obſerving to give each ſide of it a ſmall ſlope, for greater ſtrength. The top of this bank ſhould be about two feet and a half wide, and the whole of it ſhould be filled up with earth to a level with the turfs, excepting a little hollow in the middle, to retain ſome rain. Quick ſets ſhould then be planted along this top, and they will ſoon form an admirable hedge. By this means, a bank four feet high, and a ſlope only two feet deep, will make,

beſides

beſides the hedge, a fence ſix feet high, through which no cattle will be able to force their way: for the roots of the graſs will bind the turfs ſo together, that, in one year's time, it will become entirely ſolid, not a joining will appear, nor a turf can be got out; and it will be yet much ſtronger, when the roots of the quick ſhall have ſhot out among it. The only precautions neceſſary to be obſerved here, are, 1. not to make this bank when the ground is too dry; becauſe, if a great deal of wet ſhould ſuddenly follow, it will ſwell the earth ſo much as, perhaps, to endanger the falling of ſome of the outſide; which, however, is eaſily remedied if it ſhould happen; and 2. if the ſlope be ſuch as ſheep climb can up, to ſecure the young quicks, at the time of planting them, by a ſmall dead hedge, either on or near the top, on both ſides. If any of the quicks ſhould die, which they will hardly be more apt to do here than elſewhere, unleſs perhaps in extreme dry ſeaſons, they may be renewed, as in other places, by planting new ones, or by layers from thoſe which remain.

A fence like this will do even for a park; eſpecially if poſts and rails, about two feet high, are placed a little ſloping over the ſide of the bank, on or near it's top: for no deer will be able to jump over this, nor can they creep through it.

This is one of the beſt fences to afford ſhelter for cattle; and if the quick on the bank is kept well clipped, it will form a kind of green wall, pleaſing to the eye.

When the bounding fence is only to guard againſt accidents from without, it may be made in the ha-ha manner; only taking care that the earth be ſo well rammed down at the back of the wall, as that the ſtones may be properly ſupported, and bear equally.

CHAP.

CHAP. VI.

OF THE SITUATION OF FARMS AND FARM-HOUSES.

THE ancient writers on husbandry, who lived in warm countries, where the heat and moiſture of the air had ſenſible, and frequently very dangerous, effects on the health of the inhabitants, were very particular in their directions for the choice of farms, or eſtates, and of the ſpots whereon houſes ſhould be built, ſo as to avoid the inconveniencies ariſing from the climate, or from the quality or ſituation of the ground.

Though the temperate air which we enjoy in this iſland renders ſuch directions leſs neceſſary here; yet, as ſeveral places in it are remarkably ſickly, and as, even in the moſt healthy ſituations, many houſes and villages are built on the leaſt healthy ſpots; it muſt be of conſiderable advantage to thoſe who can make their choice, to know what ſites and places ought to be avoided; and to ſuch as are already fixed, to be acquainted with the means of correcting thoſe inconveniencies which cannot be totally remedied.

Inſtructions of this kind are now full as neceſſary in our language, as they ever were in the Greek or Latin; the countries in which Engliſh is ſpoken being more extenſive, and more various in their climes, than even the Roman empire ever was.

The rule which I have preſcribed to myſelf, of treating each ſubject of this work as conciſely and as plainly as it's nature can well admit of, will not permit me to enlarge on this article, ſo much as it's importance deſerves, or in ſo full a manner as might juſtly be expected from an author who ſhould

ſhould write (what there is great room for) a diſſertation profeſſedly thereon. Thoſe who can have recourſe to the originals from whence the following directions are chiefly taken, or to others who have expatiated largely on this important matter, will hardly reſt ſatisfied with what can, with any propriety, come within the remaining limits of this treatiſe.

The ſacrifices of the ancient Romans ſhew how attentive they were even in the choice of the ground they encamped upon: much more were they ſo in that of the ſituation and nature of the place where they laid the foundations of more laſting buildings. They examined the livers of cattle fed on the ſpot, when they offered them in ſacrifice; and if theſe were lived or corrupted, they offered others, as the unſoundneſs of the firſt might be owing to ſome caſual diſtemper: but if they were often found to be morbid, they concluded that the air, water, or food, which the place yielded, would have a like effect on human bodies, and therefore ſpeedily left that ground, to ſearch for a better ſituation. If, after repeated trials, they found the livers good, they judged the air and food to be ſo likewiſe, and ſettled accordingly. —— We may ſtill obſerve the good effect of this precaution, in the healthy ſituations of the remains of Roman encampments: for they preferred health to every other conſideration.

The Romans had pleaſure, as well as profit, in view, when they bought or ſtocked a farm; and therefore they laid it down as a rule[a], that no degree of fertility ſhould tempt a man to purchaſe in an unhealthy country, nor the pleaſanteſt ſituation in a barren one. "Buy not too haſtily",

[a] L. I. M. COLUMELLÆ, *de Re ruſtica, Lib.* I. *c.* 3. *et. c.* 4. PALLADII, *de Re ruſtica, Lib.* I. *Tit.* 2. *et Tit.* 7.

ſaid the wiſe Cato [b], "but view again and again "the purchaſe you intend to make; for if it be "a good one, the oftener you ſee it, the better it "will pleaſe you. Examine how the neighbour-"ing inhabitants fare. Let the country it lies in "be a good one; the ways to and from it, "good; and the air temperate. Let your land, if "you can chooſe your ſituation, be at the foot of a "hill, facing the ſouth, in a healthy place, where "a ſufficiency of labourers, of cattle, and of water, "may be had. Let it be near a flouriſhing town, "the ſea, or a navigable river; or bordering upon "a good and well frequented road. Let the build-"ings upon your ground be ſtrong and ſubſtan-"tial. Do not raſhly condemn the methods of "others. It is beſt to purchaſe from a good huſ-"bandman and a good improver."

Beſides the healthfulneſs of the ſituation, three other things ſhould be particularly attended to in the choice of a farm or eſtate; theſe are, the air, the water, and the ſoil. The air ſhould be pure and temperate; the water wholſome and eaſily come at; and the ſoil rich [c].

The knowledge of the healthineſs of the air is, as Lord Bacon obſerves [d], diſcoverable rather by experiment, than by reaſon or conjecture.

To examine the moiſture of the air before a houſe is built, wool, or a ſponge may be hung up in the place, and afterwards compared with ſome of the ſame, expoſed in the ſame manner, and at the ſame time, in another place. According as they gain more or leſs in weight, the air is more or leſs humid.

[b] *De Re ruſtica, Lib.* I. *c.* 1.

[c] PALLAD, *Lib.* I. *Tit.* 2.

[d] *Natural Hiſtory, No.* 777 and 937.

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The air is liable to greater alterations, from heat and cold, in ſome places than in others; and as that inequality in the air is an enemy to health, the moſt equal ſhould be choſen. This is eaſily determined by the thermometer, and by viewing the ſituation of the place; for the intermixture of hills and vallies, though pleaſing to the eye, may be held ſuſpected as to the lengthening of life, becauſe of the variations of heat and cold.

Open places and champaign countries are judged to be healthy, where the ſoil is dry, not parched or ſandy, where wild thyme and other aromatic plants grow ſpontaneouſly, and which is not otherwiſe bare, but interſperſed with trees for ſhade. Yet the change of air in travelling, after being accuſtomed to it, is healthy: whence many travellers have proved long lived; as, indeed, have alſo ſuch as have dwelt conſtantly in the ſame cottage. —— A ruddy complexion, clear white of the eye, quick hearing, and diſtinct voice, are ſet down by Palladius [e], as marks of the healthfulneſs of the place where theſe circumſtances are met with in the generality of it's inhabitants.

The ancients were particularly attentive to the quality of their water, and to the eaſe of coming at it. They adviſed [f] bringing into the farm-houſe the water of a ſpring which never dries up; or, if there be no ſuch ſpring within the farm, to bring running water as near to it as may be; or to dig for well-water, not of a bitter or brackiſh taſte. If neither of theſe was to be found, they directed large ciſterns to be provided for men, and ponds for collecting and retaining rain water for cattle. They eſteemed that running water to be beſt for

[e] *Lib.* I. *Tit.* 3.

[f] VARRO *Lib.* I. *c.* 11. COLUMELLA, *Lib.* I. *c.* 5. PALLAD. *Lib.* I. *Tit.* 2.

drinking, which had it's ſource in a hill: ſpring, or well-water, from a riſing ground, was deemed the next beſt: well-water in the bottom of a valley was held to be ſuſpicious; and marſhy or fenny water, which creeps ſlowly on, was, by them rightly looked upon as the worſt of all.

That water is known to be wholſome, which has no mineral in it, is perfectly clear, has no taſte or ſmell, depoſits no ſlimy ſediment, leaves no ſpots, or incruſtation when boiled in copper or braſs veſſels, and which boils pulſe in a very little time. "Rain water", ſays Sir Thomas Elliot in his Caſtle of Health, "is the moſt ſubtile and pure of any "other water. The next is that which iſſueth out "of a ſpring facing the eaſt, and paſſeth ſwiftly "among great ſtones and rocks. The third is "of a clear river, which runneth on hard ſtones "and pebbles. —— There be divers means to "try which is the beſt water; for that which is "lighteſt in poiſe or weight, is beſt; alſo that "whereof cometh leaſt ſcum or froth when it "doth boil; alſo that which will ſooneſt be hot. "Moreover, dip linnen cloths in ſundry waters, "and afterwards lay them to dry; and that which "is ſooneſt dry, the water wherein it was dipped, "is moſt ſubtile."

As ſprings and well water paſs through beds of ſand, gravel, or ſmall ſtones, theſe clear it of all impurities, unleſs there be mixed with them ſubſtances which are ſoluble in water. If any mineral is mixed with the water, it is unfit for the farmer's uſe. If it be hard, it is thereby rendered unfit for waſhing and ſome other culinary uſes. This is the kind of water which gives fleſh boiled in it a red colour. But even the hardeſt water may be eaſily rendered perfectly ſoft, and fit for any uſe, by mixing with it a ſmall proportion of pot-aſh, fixed ſalt, or, for want of theſe, the aſhes of any burnt vegetables,

vegetables, as will be more fully directed in the article of *Brewing*.

The animal and vegetable ſubſtances which are mixed with ſtagnating water putrify, and taint that water. This taint is moſt effectually carried off by boiling, during which all the putrid particles evaporate; and whatever elſe remains in it will ſubſide when it is cold. It may likewiſe be much mended by having air forced through it by means of Dr. Hales's ventilator; or it may be corrected by mixing with it acids, ſuch as vinegar, juice of ſour fruits, ſpirit of nitre, vitriol, &c.

When there is neither running nor ſpring water, artificial ſprings may be made in the manner thus pointed out by Lord Bacon [g], who does not indeed ſay that he had experienced it himſelf; but it has been repeatedly tried ſince his time, and found to anſwer very well. "Upon a hanging ground, where there is a quick fall of rain water, lay a half trough of ſtone, of a good length, three or four feet deep in the ground, with one end upon the high ground, the other upon the low. Cover this trough with brakes, to a good thickneſs, caſt ſand upon the top of the brakes, and you will ſee, after ſome ſhowers are paſt, the lower end of the trough run like a ſpring of water." This will continue for a long time after the rain is paſt, "as if, ſays that great philoſoper, the water, did multiply itſelf upon the air, by the help of the coldneſs and condenſation of the earth, and the conſort of the firſt water." ——— A gentleman in France, whoſe manſion ſtood on a height far from any water, was adviſed to make a long ditch, about a fathom deep, in the neighbouring higher grounds, and to fill it with ſand; he did ſo, and it con-

[g] *Natural Hiſtory*, No. 25.

tinued to bring a plentiful ſupply of water, for all domeſtic purpoſes.

M. de la Hire obſerves, in the Memoirs of the Academy of Sciences for the year 1703, that rain water which has been purified by paſſing through clean ſand, and is afterwards collected in ſubterranean reſervoirs, will keep a long while without becoming putrid. He thinks this water the beſt that can be made uſe of, either for drinking, or for other economical purpoſes, becauſe it is not impregnated with any mineral, as ſpring waters ſometimes are. The only thing requiſite in the conſtruction of ſuch reſervoirs or ciſterns is, to have a place which will hold water, made of ſuch materials as will not communicate any bad quality to the water which is to remain there a conſiderable time. The firſt water that falls from the roofs of houſes, when it begins to rain, ſhould be thrown away; as having ſerved only to waſh the roof, which, in dry weather, is always covered with dung of birds, and other filth. He rejects ſnow water for the ſame reaſon; and likewiſe the water of rain brought by winds which paſs over places infected with ill ſmells, as large cities, ſinks, &c. He computes, that water enough for the uſe of any family, runs off the roof of the houſe which is inhabited by that family *;

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* That illuſtrious ornament to his profeſſion, the great and learned Dr. Mead, ſpeaking of water h, "which is of ſo conſtant ſervice, not only for our drinks, but alſo in preparing of our fleſh and bread, that it may juſtly be ſaid to be the vehicle of all our nouriſhment, obſerves, that whenever this happens to have other properties than are neceſſary to fit it for this purpoſe, it is no wonder if it in it's paſſage through the body theſe make ſuitable impreſſions there.

"Thus at Paris, where a part of the city is ſupplied with water from Arcueil, which is ſo full of ſtony particles,

h *Mechanical Account of Poiſons, Eſſay* VI.

"that

The buildings on the farm ſhould be proportioned to the produce, eſpecially as to ſtore-rooms

" that even the pipes through which it runs, are in time incruſted and choaked up; Dr. Liſter has obſerved, that the " inhabitants are more ſubject to the ſtone in the bladder, than " in moſt other places.

" In like manner let the groſs particles, with which the " water is ſaturated, be of any other nature, metallic, ſaline, " &c. theſe, according to their various gravity, the capacity of " canals, and ſuch like circumſtances, will, when they come to " circulate in the animal body, be by the laws of motion de- " poſited in one part or other. So theſe mineral bodies, and " nitrous ſalts, which abound in the ſnowy waters of the Alps, " do ſo certainly ſtuff and enlarge the glands of the throat in " thoſe who drink them, that ſcarce any who live there are " exempted from this inconvenience †.

" For this reaſon, the choice of water for drink among the " ancients was by weight; the lighteſt being preferred, as " moſt free from all heterogenious bodies.

" A great abuſe committed about this city, is in chuſing " ſometimes ſtagnating impure well-water for the brewing of " beer, and making other drinks. Such a fluid indeed has " often times a greater force and aptneſs to extract the tincture " out of malt, than is to be had in the more innocent and ſoft " liquor of rivers: but for this very reaſon it ought not, " unleſs upon mere neceſſity, to be made uſe of; this quality " being owing to the mineral particles and aluminous ſalts, " with which it is impregnated.

" A late author i, by ſearching into the firſt accounts of the " diſtemper we call the Scurvy, deſcribed by Pliny k and " Strabo l, under the promiſcuous names of *Stomacace* and " *Scelotyrbe*; and examining the authentic hiſtories of it in " later years, made by the moſt obſerving phyſicians in thoſe " countries where it was unhappily revived, as Olaus Mag- " nus, Balduinus Ronſerus, J. Wierus, Solomon Albertus, &c. " finds that the origin of it was in all times and places " charged upon the uſe of unwholſome ſtagnating waters. Then " by comparing together the clayey ſtrata of the earth about

† *Quis tumidum guttur miratur in Alpibus?*
Juvenal. Satyr. 13.

i Dr. J. H, *Scelera aquarum: or, a Supplement to Mr. Graunt on the bills of mortality.*

k *Lib.* XXV. *c.* 3.

l *Geogr. Lib.* VI.

rooms [p]. The expence of building ſhould be ſuch, as that, in caſe of accidents, one, or at moſt two years rent may repair them. The farm-houſe ſhould be ſomewhat elegant, to give pleaſure to it's poſſeſſors, and, as Columella adds [q], to allure the wife to take delight in it. It ſhould be built on the moſt healthy ſpot of the farm, in a temperate air, ſuch as the middle of a hill commonly enjoys, where it is neither ſtifling in the ſummer, nor expoſed to the rage of winds and ſtorms in

p CATO, *Lib.* I. *c.*3. VARRO, *Lib.* I. *c.*12. q *Lib.* I. *c.*4.

" the cities of London, Paris, and Amſterdam, he ſhews, that " where the water is worſt, this malady is moſt rife. So that " he has put it out of all doubt, that moſt of the perplexed " and complicated ſymptoms, which are ranged under this one " general name, are in a great degree owing to the ill qualities " of this element. — From hence often proceed, not only pain " in the limbs, livid ſpots in the ſurface of the body, ulcers, &c. " occaſioned by the acrimony of the undiſcharged moiſture, by " which the ſmall canals of inſenſible perſpiration are frequent- " ly ſtopt and obſtructed (for it is upon this ſcore that Sancto- " rious teaches us [m], that heavy water converts the matter of " tranſpiration into an ichor, which being retained induces a " cachexy); but alſo many of thoſe nervous complaints, which " go by the name of hyſterical and hypondriacal, may take " their riſe from the ſame ſource: for the before cited Sancto- " rious has obſerved [n], that the flatus or wind, ſo inſeparable " from thoſe caſes, is no other than the fluid of perſpiration " rude and unfiniſhed.

" If theſe inconveniencies are oftentimes not felt, at leaſt " not till towards the declining age, in ſtrong and active habits " of body; yet I am, from very good experience, aſſured, that " they deſerve conſideration in weaker conſtitutions, and a " ſedentary life; eſpecially of the more tender ſex.

" For theſe reaſons Pliny tells us [o], that thoſe waters are con- " demned in the firſt place, which, when boiled, incruſtate " the ſides of the veſſels. And that our well-waters do this, " no body who looks into the common tea-kettle, can be " ignorant."

m *Medic. ſtatic.* §. II. *Aphor.* 6.
n *Ibid.* §. III. *Aphor.* 13.
o *Lib.* XXXI. *c.*3.

the

the winter. It may be ſeated near a quick running river, if the banks are high, and the channel clear of mud: but if the river is large, care muſt be taken to ſituate it ſo that the winds may carry off the vapours in ſummer, and the fogs in winter, which otherwiſe would prove hurtful to the health of men and cattle. The front of the houſe ſhould be turned from ſuch a river.—In a healthy ſituation, a houſe ſhould front the ſouth eaſt, which is ſhaded during the hotteſt part of the day in ſummer, and enjoys the morning ſun in the winter. A houſe facing weſterly will have the morning fogs longer retained, and will be too much heated by the afternoon ſun. — In an unhealthy ſituation, the front ſhould be turned toward the north.

In ſouthern climates, where the ſun is within a few degrees of being vertical in ſummer, and yet the country is ſubject to ſevere cold in the winter, as is the caſe of ſome of our north American colonies, a ſouth front is rather convenient: for in the heat of the ſummer, the ſun, being high, paſſes over the roof from the eaſt ſide to the weſt, and ſhines but little, or not all, in at the front windows, and very weakly, becauſe obliquely, upon the front wall. But in the winter, being low, it ſhines full in at theſe windows, at a time when the cold renders it's cheering preſence quite agreeable.

Places in this kingdom intended for defence, before the invention of cannon, were built either on riſing grounds difficult of acceſs, or where they could eaſily be ſecured by moats filled with water. Villages and farm houſes were moſt frequently built in vallies, that they might be ſheltered from ſtormy winds; or near brooks or rivers, for the conveniency of water. — In general, every means have not been uſed to provide againſt the inconveniencies of theſe ſituations: though as Mr. Worlidge

Worlidge obſerves, "were we for the future but "duly to obſerve the beſt ſituations of places, and "the completeſt methods of building, in ſuch "houſes as may hereafter be raiſed; our England "would in a few years appear a kingdom beſet "and adorned with curious and admirable habita-"tions, poſſeſſed by noble and ingenious inhabi-"tants."

Houſes built on too lofty a ſituation are expoſed to the violence of the winter's ſtorms, and to the ſcorching drought of the ſummer: yet we too generally find them without the only ſhelter their ſituation admits of, which is, wood. The reaſon of this ſeems to be, that the inhabitants, finding that trees do not thrive well when they are firſt planted on dry heights, are at once diſcouraged. But where the plants are fenced from nipping winds while young, and protected from cattle till they become ſtrong, ſuch ground would be found abundantly favourable to the growth of trees which delight in a dry ſoil, as will hereafter be ſhewn fully, when I come to treat of foreſt trees. "Theſe, as Mr. Worlidge expreſſes it [1], would "yield a cooling, refreſhing, ſweet, and healthy "air and ſhade during the heat of ſummer, and "very much break the cold winds and tempeſts "from every quarter in the winter."

One might be apt to think, from the unhealthineſs of low and fenny countries, that moats full of water about houſes ſhould be prejudicial to health: yet many facts ſhew the contrary. In No. 310 of the Philoſophical Tranſactions, a particular inſtance is given of two pariſhes which were ſurrounded with a moraſs, and yet were very healthy. Many houſes ſurrounded with moats are drier than others in a ſeemingly better ſituation;

[1] *Syſtema Agriculturæ, p.* 235. [2] *Ibid p.* 236.

for

for books and furniture are often leſs apt to grow mouldy in the former, than in the latter. Hence it would ſeem probable, that the unhealthineſs of low marſhy countries muſt ariſe, rather from the putrefaction of animals and vegetables in ſlow moving or ſtagnating waters, than from a too great moiſture of the air, occaſioned by the quantity of water evaporated. Of this Dr. Pringle gives a remarkable inſtance in his moſt judicious and uſeful Treatiſe on the diſeaſes of the Army, when he ſays [s]; "Another cauſe of the moiſture and "corruption of the air, were the inundations made "about the fortified towns ſince the commence-"ment of the war; which were particularly "noxious upon letting the water off in the be-"ginning of the ſummer, after the preliminary "articles of the peace were ſigned. For theſe "grounds, which were once entirely covered, be-"ing now half drained and marſhy, filled the air "with moiſt and putrid exhalations. The ſtates "being made ſenſible of this, by the ſickneſs "that raged at Breda, and the neighbouring vil-"lages, gave orders to let in the water again, and "keep it penned up till winter.".

All phyſical writers point out the great danger to which health is expoſed from a moiſt and warm air; eſpecially if it be attended with a putrid vapour. Too much care cannot therefore be taken to guard againſt both. The too great moiſture may probably be prevented by collecting all the waſte water into deep ditches or ponds. We frequently ſee that ponds which have no ſupply of water but from rain, retain water during a very dry ſummer, when, according to the uſual calculations of evaporations, the whole muſt have diſappeared in half the time: from whence it ſeems

[s] Page 63.

more

more than probable, that the quick evaporation of water, in ſome caſes, muſt ariſe from a heat reaching to, or affecting, the earth under the water; and that, if care be taken to make the ditches or ponds ſo deep that the heat of the ſun ſhall not warm the earth at their bottom, the quantity evaporated will be but ſmall, and ſuch as will not be prejudicial to the health of the neighbouring inhabitants, if neither animal nor vegetative bodies are ſuffered to rot in them. The way to prevent this is by keeping the water free from graſs, or other impurities, which may give ſhelter to animals, whoſe rotting, as well as that of the graſs, or of thoſe impurities, communicates a putrid taint to the exhalations. It is in this caſe neceſſary that the banks of the ditches or ponds be ſloped as little as the ſtrength or ſtiffneſs of the earth will permit.

Though lofty and bleak ſituations are too often deſtitute of trees, villages built in vallies are as frequently too much crowded with them; which muſt be attended with the inconvenience of not having a free circulation of air, to carry off the moiſture ariſing from the earth, and perſpiring from ſo many trees. — The antients would have built ſuch villages on riſing grounds, to avoid the too ſultry heat of the ſummer; or they would have preſerved a free circulation of the atmoſphere, to prevent the bad effects of a ſtagnating moiſt air.

On the firſt ſettlement of the Engliſh in North America, they imitated our cuſtom of building in vallies, and near rivers: but experience ſoon taught them, that ſuch places are more ſubject to the ſuffocating ſultry heat of the ſummer, and, what they little expected, to a greater ſeverity of froſt in the winter, than riſing grounds generally are. I have been informed by one of the moſt curious

curious and intelligent obſervers of the laws of nature, of perhaps any man on that continent, that the cold there, in their hardeſt froſts, is found to be ſo ſevere in the vallies, to a certain height, as ſometimes to kill every tender vegetable, while thoſe on the higher grounds eſcape. This generally takes place to a regular determined height, above which the Americans now build their houſes. —If I might be allowed to offer a conjecture concerning the cauſe of this, I ſhould ſay, that the effect of the cold ſeems to be limited to the height to which the great moiſture of the air riſes at that ſeaſon. In the hard winter of 1741 the ſame happened in this kingdom, when the froſt was much leſs ſevere in it's effect in the hilly countries, than in the low lands.

Dr. Pringle, in his moſt excellent treatiſe before mentioned, points out the diſadvantages of planting ſo many trees as there generally are in moſt parts of the Netherlands. The ſame practice may be as juſtly blamed in many of the flat moiſt counties in England, eſpecially where they border on marſhes. Their ſpeedy growth tempts the inhabitants to plant, at the ſides of their ditches, willows, and other trees which delight in a moiſt ſoil, and theſe not only prevent a free circulation of air, but alſo perſpire a great deal of moiſture. Dr. Pringle confirms this by the following inſtances [u].

"At Eyndhoven, two battalions of the guards "were quartered in the town, and the third lay "without, in the peaſant's houſes; all within the "compaſs of a mile: yet, what was remarkable, "this without the town had always three times "more ſick in the returns, than either of the "other two; notwithſtanding one of them had

[u] Page 64.

been

"been very ſickly the year before in Zealand. "Now the height of the ground being alike in "all, the difference in point of health could be "aſcribed to nothing, but to the greater moiſture "of the cottages; for in all other points, theſe "corps were equal, as in diet, duty, and exer- "ciſe. A ſimilar caſe occured in the cantonment "of a regiment of foot; whereof one company "being quartered in houſes that ſtood upon a "heath, enjoyed a tolerable degree of health, "while the reſt that dwelt in a wood, were re- "markably ſickly. As a farther proof how pre- "judical it is to have the air confined by cloſe "plantations in ſo moiſt a country, it was obſerva- "ble, that the Dutch camp at Gilſen, bordering "on our cantonment, but lying on an open heath, "preſerved a good ſhare of health, while we were "at the worſt. — It was not a little curious to "obſerve [x], how the agues declined proportiona- "bly with the withering and falling of the leaf. "At this time leſs moiſture aſcends, and by "the ſhedding of the leaves the villages come "to be more open and perflated, and of courſe "more dry and healthful. —— While the troops "were very ſickly in Zealand [y], Commodore "Mitchel's ſquadron, which lay all this time at "anchor in the channel between South Beverland "and the iſland of Walcheren, in both which "places the diſtempers raged, was neither afflict- "ed with fever or flux, but amidſt all that ſick- "neſs enjoyed perfect health. A proof that the "moiſt and putrid air of the marſhes was diſſipat- "ed, or corrected, before it could reach them; "and that a ſituation open to the winds, is one "of the beſt preſervatives againſt the maladies of "a neighbouring low and marſhy country."

x Page 67. y Page 58.

The

The drieſt ſpot in a low flat or fenny country ſhould be choſen for a dwelling place. Even where there is gravel or ſand on the ſurface, care ſhould be taken that the ſprings do not riſe high. Dr. Pringle points out the neceſſity of this caution, from what he obſerved in the lower parts of Brabant [z], "which is a barren ſand, where ſo little water is "ſeen, that, at firſt ſight, the country is deemed "dry and healthful: but the appearance is de-"deceitful; for water is every where to be found "at two or three feet from the ſurface: and in "proportion to it's diſtance from thence, the in-"habitants are more or leſs free from diſeaſes.

Mr. Worlidge directs that [a], in low moiſt grounds cellars ſhould be made under the houſe, with good cieling; for that this will conduce much to it's dryneſs and healthfulneſs. The importance of rendering houſes dry appears in many inſtances mentioned by Dr. Pringle: but I ſhall give only that in his 12th page. "One quarter of Ghent, called "St. Peter's hill, ſtands high above the reſt of the "country; and in this the barracks, having drains "and free air, were quite dry; ſo that the men "who lay there enjoyed perfect health. But the "reſt who were quartered in the low part of the "town, where their barracks were moſtly the "ground-floors of waſte houſes without drains, "and of coarſe very damp, were all ſickly."

The bed chambers, in ſuch ſituations, more eſpecially, ſhould be in the dryeſt and moſt elevated part of the houſe, and where the morning ſun may contribute moſt to keep them dry [b]. If they are ſo ſituated, that the ſun does not warm and dry them, they ſhould be frequently aired with

[z] Page 62.

[a] *Syſtema Agriculturæ*, C. XI. §. 5.

[b] COLUMELLA, *Lib.* I. *c.* 6.

fires;

fires; the oftener in proportion to the greater dampneſs of the place: for this has been found to contribute greatly to the health of the inhabitants.— I am informed by a gentleman who has experienced it in many inſtances, that, by this ſole precaution, he has preſerved ſeveral families from the ague, when that diſtemper was very epidemic in the neighbourhood. How much the dryneſs of bed-chambers contributes to health, is confirmed by what Dr. Pringle obſerves to have happened at Bruges, where the ſoldiers that lay in the upper ſtories kept their health remarkably better, than thoſe who were below on the ground floors.

As brick walls render houſes dryer than thoſe of ſtone, and of a more equal warmth than plaiſtering, Mr. Worlidge directs [c], that, "where bricks "can be had, the walls ſhould be built with them, "as may be done for little coſt, if you raiſe firm "and ſtrong columns at the corners of the houſe, "and where it is neceſſary to ſupport the main "beams. You may build theſe ſquare, and be"tween them raiſe the walls with the ſame mate"rials, and work them up together with the "corners and columns, leaving one half of the "extraordinary breadth of the column without, "and the other within the walls; thereby you "will ſave much charge in materials and work"manſhip, and yet your houſe will be firm and "ſtrong."

We are too little attentive to the ſituation of houſes with regard to rivers; though a judicious choice in this muſt be of great conſequence to the health of the inhabitants. A quick flowing ſtream, with a clean channel and dry banks, will rather add to the beauty and healthineſs of a country: but

[c] *Ubi ſupra, p.* 237.

oozy

oozy banks over-run with reeds, or other ſtrong coarſe graſs, ſhould be carefully avoided, as being a ſhelter to all manner of putrid filth, from whence unſalutary vapours muſt ariſe. It is a general opinion, that it is ſafer to dwell on the north, than on the ſouth, ſide of ſuch a river. Yet it has been obſerved by a moſt ingenious gentleman, whoſe long reſidence in warm climates has afforded him ample opportunities of knowing the truth, that an oozy ſlow moving river, or a putrid marſh, is leaſt hurtful on the north ſide of a dwelling place. The reaſon aſſigned by him is, that the ſoutherly winds being warm, putrefaction is thereby promoted and increaſed in ſuch a river, or marſh, and the vapours are alſo more copiouſly raiſed. Theſe vapours do not riſe high into the air rendered light by the warmth of the ſouth wind, but rather glide along the ſurface of the earth, where they are moved by a gentle breeze, and ſo are brought into the houſes, and breathed by the inhabitants, to the injuring of whoſe health their miſchief is not confined; for they alſo hurt their furniture, and even their utenſils of husbandry: whereas when the north winds blows, the air is generally cool, putrefaction is checked, fewer vapours ariſe, and theſe, by the greater denſity of the air, are ſooner raiſed high and diſſipated. Northerly winds are alſo generally briſker; and therefore the air has leſs time to be tainted in paſſing over ſuch river or marſh. The ſame quantity of vapour ariſing in any given time, is diluted as it were, and it's power weakened, by being mixed with a greater quantity of air. Add to this, that, poſſibly, the human body, being more relaxed when the warm and ſoutherly winds blow, may then be more ſuſceptible of the injuries occaſioned by theſe moiſt and putrid exhalations. —

Marſhes which are ſometimes overflowed with ſalt water, are found to be more unwholeſome than freſh water marſhes. Their neighbourhood ſhould therefore be carefully avoided.

Laudato ingentia rura, — exiguum colito [d], "commend extenſive demeſnes, but occupy a ſmall farm", was a precept univerſally received by the ancient Romans, who laid it down as a rule, that the farmer ought to be ſtronger than the farm, becauſe, in the ſtruggle which muſt ariſe between them, if the farm be too ſtrong for the farmer, he muſt be ruined [e]: that is, if the extent of his farm be ſuch that he cannot beſtow a due culture on every part of it, he muſt thereby become a loſer: for, as Columella remarks [f], "it is certain "that a large tract of land not rightly cultivated, "will yield leſs than a ſmaller ſpace well cultivat-"ed. — The ſeven *jugera*, adds he, which Lici-"nius the Tribune of the people diſtributed to "each man, yielded a greater increaſe, in propor-"tion, than our large farms, in the manner we "now cultivate them."

This reflection may, with equal juſtice, be applied to this kingdom, where the landlords of late ſtudy to throw their eſtates into very large farms; becauſe, ſay they, it leſſens the expence of repairs, and diminiſhes the number of poor. But it may perhaps be queſtioned, whether the landlord does not become as great a loſer by the failure of one ſuch conſiderable tenant, as the expence of more numerous repairs would amount to: and that theſe failures muſt be frequent, is pretty certain; becauſe landlords cannot always find farmers ſufficiently wealthy to ſtock ſuch farms without

[d] VIRG. *Georg. Lib.* II. 412.

[e] COLUMELLA, *Lib.* I. c. 4. *Ibid.*

borrowing,

borrowing, whereby they contract a debt which remains an internal canker in their vitals, and gradually eats them up; or being young and unexperienced, their great and certain expence ſoon conſumes their ſtores. — Two great evils, of a public nature, attend this practice. The land cannot be ſo well cultivated as it ought, and therefore cannot yield it's utmoſt produce: and the country, that great ſource of population, muſt be unpeopled; as Italy was in Columella's time.

END OF THE THIRD VOLUME.